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# REVIEW of EDUCATIONAL RESEARCH

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Volume I

DECEMBER, 1931

Number 5

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## PSYCHOLOGY OF THE SCHOOL SUBJECTS

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AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

A Department of the

NATIONAL EDUCATION ASSOCIATION

1201 SIXTEENTH STREET NORTHWEST

WASHINGTON, D. C.

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Entered as second-class matter April 18, 1931, at the post office at Washington, D. C., under the Act of August 24, 1912.

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*Official Publication of the American Educational Research Association, a department of the National Education Association.*

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Volume 1

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## PSYCHOLOGY OF THE SCHOOL SUBJECTS

Prepared by the Committee on Psychology of the School Subjects:  
FREDERICK B. KNIGHT, PERCIVAL SYMONDS, and ARTHUR I. GATES,  
*chairman.*

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## PREFACE

THE field of the psychology of the school subjects is not very clearly marked off. From a broad point of view studies in the objectives of the curriculum, studies in method or studies in methods of testing may be considered as psychological in nature. If studies on these topics are included in the field of the psychology of the school subjects, this field will overlap the field covered in other numbers of this *Review*. There is also, however, a distinctive set of problems which marks off this field from the others which have been dealt with. These problems are concerned chiefly with the analysis of the process of learning and of the nature of the mental operations involved in the various school subjects, together with such subsidiary problems as the nature and amount of individual differences and mental growth in these processes. The analysis of the learning processes and the determination of the abilities involved in mastering the school subjects give the underlying basis for the invention and choice of methods and throw light on the construction of the curriculum; but such analysis and determination is to be distinguished from a direct attempt to measure the effectiveness of methods, to determine curriculum objectives, or to devise educational tests.

The general aim of the present issue of the *Review* has been to emphasize the distinctively psychological problems, but it has been difficult to avoid some overlapping with other issues.

FRANK N. FREEMAN, *Chairman,*  
*Editorial Board, 1931-32.*

## CHAPTER I

### Reading

SCIENTIFIC studies of reading began in the laboratories of Europe about the middle of the nineteenth century. The problems which received most attention for fifty years or more were concerned largely with perception and eye-movements in reading. Although limited in scope, these early studies resulted in three notable contributions: first, facts were secured which presented a new and significant view of the processes involved in reading; second, many problems were discovered which stimulated keen interest in further studies of reading, both in Europe and in this country; third, rapid progress was made in the development of experimental technics and mechanical devices for securing accurate records. The way was thus paved for the detailed laboratory studies made in this country since 1900 by such men as Huey, Dodge, Dearborn, Judd, Freeman, Schmidt, Buswell, and others. With the development more recently of reading tests, of case study technics, and of other methods of securing accurate information, investigators and teachers have been able to study reading problems in the classroom, the library, the home, and other social institutions, as well as in the laboratory. As a result, the number of scientific studies made has increased at a surprising rate during recent years. Since 1900 more than a thousand studies, relating to numerous phases of reading and contributing to a clearer understanding of many fundamental problems, have been published.

#### Purpose and Scope of Chapter

This chapter is concerned with the results of studies that contribute definitely to an understanding of the psychology of reading. Those which relate primarily to curriculum problems, to methods of teaching, and to tests and measurements have been and will be summarized in other numbers of the *Review*. The adoption of this plan will doubtless result in the omission from this chapter of studies which have psychological implications. It is believed, however, that such omissions will be far less serious than the repetition of references and the overlapping with the content of chapters in other issues of the *Review*, which might otherwise result. The specific studies to which reference will be made were published during the three-year period beginning July 1, 1927, and ending June 30, 1930. The writer has taken the liberty, however, of referring frequently to summaries of earlier studies which contribute helpfully to an understanding of the topics discussed.

## **Purposes or Motives for Reading**

The purposes or motives for reading have both pedagogical and psychological significance. Hathaway (37) analyzed selected words from a dictionary to determine the kind of human activity suggested by each and the way in which reading would further that activity. The purposes of reading thus revealed were stated as follows: to gain meanings, to gain information, to guide activity, for social motives, to find values, to organize, to solve problems, to remember, to enjoy. Montgomery (56) secured information from students, teachers, housewives, professional men and women, musicians, artisans, stenographers, librarians, physicians, housemaids, ministers, and nurses, relative to the purposes of recreational reading. A study of the reports submitted resulted in the identification of the following general classes: satisfaction of curiosity, relaxation, emotional satisfaction and stimulation, culture, vicarious experience, vivid description, background or atmosphere, idle time, sense of duty, and physical attractiveness of books. Both of these studies suggested a surprising range of motives that prompt people to read.

## **Eye-movement Duration, Pause Duration, and Reading Time**

Tinker (75) studied the relation between eye-movement duration and reading time and found that "only 5.9 percent of the reading time was consumed by eye-movements," on the average. "This allowed about 94 percent for perception, i. e., pauses." It was found also that "the ratio between eye-movement duration and reading time bore a constant relationship to the reading attitude," the more careful and analytical the reading the smaller the ratio. As the mental processes involved in reading became more complex "the reading pauses consumed a relatively greater percent of the total reading time." Similar tendencies were reported in earlier studies.

## **Nature of Visual Apprehension and Perception in Reading**

The fact is well known that the span of perception is an important factor in reading achievement. Tinker (78) summarized 110 studies relating to visual apprehension and perception in reading to determine their nature. His survey led to the conclusion that there is "a natural tendency to combine the different elements of a visual impression into higher units whenever grouping is possible," also that "word form is a very important factor in word perception and that characteristic word form arises from an alternation of 'dominant' letters of letter complexes with 'indifferent' letters. It is also evident that no individual can be classified strictly as an objective type or as a subjective type, nor does any single person read by the same method in all reading situations. He may read largely by word wholes

with certain material, while with more difficult or more unfamiliar material his reading may be largely analytical."

In studies of visual perception in reading and spelling, Sister Mary of the Visitation (51) found that "ability to discriminate minute details in series of actual words and in groups of unrelated letters and to distinguish fine differences in pairs of words are pre-eminent factors in reading." These findings correlated closely with previous conclusions reached by Gates. Further evidence of the importance of perceiving details of words was secured in a study by Smith (74), who found that ability to match words was closely correlated with progress in learning to read.

### **Reading and the Perceptual Span**

In earlier summaries of reading studies (29), differences between the amount recognized in short exposure experiments and in actual reading, as revealed by eye-movement records, were pointed out. The impressive fact emphasized was that readers do not approach the limit of the perceptual span in actual reading. An elaborate study reported by Payne (66) in 1930 indicated that it is difficult to measure with accuracy the "perceptual span." The data secured led to the tentative conclusion that difficulty in learning to read does not relate so much to the amount recognized at one fixation as it does to "automatizing the right responses. The amount of reading matter which can be responded to accurately appears to depend upon training and to a limited extent upon maturity."

In studies carried on to find out how formulæ are read, Tinker (76) found that the average perceptual span for items in formulæ was nearly twice as great as for unrelated letters: "Five kinds of difficulties were noted by the observers in reading briefly exposed formulæ. They were largely legibility factors and consisted of (a) smallness of type, (b) lightness of face of type, (c) compactness and complexity in formula structure, (d) italicized type, and (e) length of formula." The general conclusion reached was that "the perceptual span for items in formulæ is greater than for unrelated characters, and that this larger span is due to a tendency toward configuration."

Crosland and Johnson (13) studied the effect of inter-letter "hair spacing" and the characteristics of individual letters on "the range of apprehension." They found that inter-letter spacing did not appreciably affect the span. Very small differences in legibility were found between vertical, curved vertical, diagonal, and curved letters. Seraphed letters, on the other hand, were more legible than unseraphed letters.

### **Reading Readiness**

McLaughlin (52) secured data in Los Angeles and San Diego which indicated that an outstanding cause of non-promotion in the first grade is a

degree of mental immaturity that makes it impossible for many pupils to learn to read. Risser and Elder (71) found that the type of mental stimulus and general learning received by pupils in the kindergarten contributed to success in learning to read in the first grade. Raybold (69) found that pupils with a mental age of seventy-six months made more satisfactory progress than those less mature. "Further research is necessary . . . to ascertain whether formal reading may be successfully taught at a mental age lower than seventy-six months." This age is somewhat higher than that recommended as a result of previous studies. Additional studies are desirable to determine not only the degree of mental maturity essential but also other requisites for rapid progress in learning to read.

### **Individual Differences in Achievement**

Early studies (29) of reading revealed four impressive facts relative to the achievement of pupils in reading. The first is that children differ widely in achievement; the second is that there is great overlapping in achievement from grade to grade; the third is that a given pupil is much more advanced in some phases of reading than in others; the fourth is that pupils progress at different rates. Scores of studies made during the last five years confirmed the foregoing conclusions with respect to elementary- and high-school pupils. Anderson (2) carried on a series of studies to determine individual differences in the reading ability of college students. Extreme differences were found as measured both by standardized reading tests and by special reading tests constructed by the study. When various items were correlated with reading achievement, the results showed that achievement was influenced slightly by sex, age, social status, and year in college. No one of these influences operating singly was of sufficient importance to necessitate differentiation of instruction on that basis. The correlation was very much higher in the case of intelligence and general word knowledge, as measured by the *Holley Vocabulary Scale*.

### **Relation between Reading Achievement and Intelligence**

Most of the studies (29, 30, 31) which have been made of the relation between reading achievement and intelligence at the elementary- and the high-school levels showed that there is a greater or less degree of positive correlation between them. The fact that all pupils of the same mental age or of the same intelligence quotient do not score equally high on reading tests indicated that factors other than intelligence influence progress in reading. The fact that the correlation differed for the same group of pupils when different reading and intelligence tests were used suggested that somewhat different abilities may be measured. Anderson (2) studied the relation between reading achievements and intelligence in the case of college students and found that it was high. He pointed out that the intelligence score was doubtless influenced by the ability of students to read.

### **Progress in Different Phases of Reading**

Early studies (29) of progress in reading showed that pupils grow rapidly during the primary grades in rate and accuracy of oral reading, that they advance steadily but less rapidly during the middle grades, and that they make only slight progress during the upper grades. In rate of silent reading, pupils advance rapidly during the primary and middle grades and approach maturity in the upper grades. In the case of depth of comprehension there is steady progress throughout the grades and high school. Studies made more recently are very illuminating. Charles (8) found that a child between two and three years of age with an I. Q. of about 125 made surprisingly rapid progress in learning to recognize words and phrases presented on charts. Tests given in Denver (19) showed that ability to interpret stories and poems and ability to select facts improved readily in grades 3B to 4A and that this growth was followed by a "pronounced flattening out of the lines of growth from 4A to 6A." In the case of ability to understand exact directions the growth curve is more uniform and pronounced from grades 3B to 6A, inclusive. Hildreth (39) found that growth in reading achievement, as measured by the *Stanford Achievement Test*, is practically uniform from the second to the eighth grades, inclusive. Studies of individual growth curves indicated "significant differences in rate of growth but little differences in the value of the growth curve." Dawson (16) found that the rate of articulation, which is closely related to fluency in oral reading and often limits the rate of silent reading, increases most rapidly during the first three grades. All subsequent grades excepting the fourth and ninth showed increases over the preceding grades. Pyle (67) found that the reading span, as measured by short exposure exercises, increased gradually up to the eighth grade and to the age of thirteen.

### **Factors Influencing Rate of Silent Reading**

Early studies (29) showed that rate of reading varies with the purpose of reading, the amount of thought given to the content, the kind of subject-matter read and the reader's familiarity with it, the difficulty of the passage, the amount of lip movement that accompanies reading, and the amount of reading that is done. Additional factors suggested by different experimenters were power of concentration, mental alertness, training in perception, habits of eye-movements, ability to grasp meaning, scholarly ability, and reaction time. More recently Tinker and Paterson (81) studied the influence of typographical factors. They found in a study of type form (80) that material set up in lower case letters was read 13.4 percent faster than that in all capitals and 2.8 percent faster than that in italics. In studies of the size of type (65), they found that pupils read material set up in ten point type from 5.2 to 6.9 percent faster than that set up in 6, 8, 12, or 14 point type. With respect to length of line (81), they found that 80 m m was preferable to lines of the following lengths: 59, 97, 114, 136, 152, 168,



and 186 m m. In a study of the effect of using numerals rather than words in arithmetical problems, Tinker (77) found that when the numbers were written as words the reading involved more and slightly shorter fixations and a longer perception time. There is need of additional research to determine all factors that influence rate of reading and their relative importance.

### **Meaning Vocabulary**

Early vocabulary studies were concerned chiefly with the number of different words in passages or books and the frequency of their repetition. More recently increased attention has been given to the meanings which attach to words and to the difficulties encountered in mastering them. For example, Fennell (24) analyzed the meanings which attached to the words in the primer and first and second readers of five series published between 1918 and 1926. She found that a surprisingly large percentage of the words had two or more meanings which should be mastered; some of them had from ten to twenty-five different meanings. She concluded that vocabulary studies which fail to consider the various meanings which attach to different words provide an inadequate measure of difficulty. Dearborn (17) carried on a study at the fourth-grade level which showed clearly that pupils are constantly encountering words which they cannot interpret adequately because of lack of appropriate experiences.

Dolch (20) studied the meaning difficulties attached to four hundred words selected from readers and found that difficulties did not correspond as closely with recurrence as might be expected. Four types of words which presented meaning difficulties were identified, namely, poetic or literary equivalents for other words which children use instead, names of things or actions with which few children are acquainted, words which relate to familiar experiences in some localities but not in others, and words which serve as symbols of abstractions or generalizations. The results of this study justify greater emphasis in teaching the meanings of the less familiar words used.

Wiley (83) in a study of errors made by beginners in reading found that pupils often use wrong cues, such as the form of the word, in recognizing the words of a passage. O'Shea (64) found that pupils who had only a mild interest in a book "gained from it an understanding of more new words than either the children who liked it very much or those who liked it very little." Such studies are essential in securing ultimately a clear understanding of the problems and difficulties involved in developing a wide meaning vocabulary.

### **Reading Interests and Preferences**

More studies have been made of the reading interests and preferences of children and adults during the last few years than of any other reading



problem. They are summarized here briefly in terms of the special groups concerned, namely, elementary-school pupils, secondary-school pupils, young industrial workers, college students, and adults.

Sister M. Celestine (49) prepared a summary of forty studies of the reading interests of elementary-school children which showed "that there are basic qualities in the content of reading material which stimulate the interest of children. This interest varies with the individual differences of age, sex, and mental ability." Dahlberg (15) found a decided preference for "thrillers" among seventh-grade pupils in New York City. Deep regret was expressed because instruction was not inculcating a love for better types of literature. Lehman and Witty (43) found that practically all children read newspapers and magazines and a large percentage read books voluntarily. Girls reported that reading consumed more of their time than was reported by boys. Norris (60) studied the magazine interests of children in two schools and found clear evidence in one school of the influence of suitable magazines for children. Lehman and Witty (44) also pointed out that the child derives much vicarious satisfaction from his interest in the funny paper. Lewerenz (47) found that the pupils who used the library widely were above the average in intelligence, and Coy (11) found that gifted children are keenly interested in reading, as a rule. A surprising lack of interest in reading has been reported in some sections. For example, the grammar-grade children of North Carolina (61) were found notably lacking in interest in reading even when books were available. With respect to poetry Eckert (22) pointed out that "the conventional type of children's poetry usually found in even the better series of school readers is not enjoyed by the children themselves so well as other poems found in the better anthologies of child verse."

Equally varied problems have been studied at the secondary-school level. Nelson (58) found that the newspaper items of chief interest are sports, the funny strips, news, and scandal. Cuzner (14) found that comic features and sport news were read more widely than any other parts of newspapers. Jennings (42) became convinced after a study of current interests of junior high-school pupils in newspapers and magazines that more guidance was needed in order to develop appropriate interests. Henderson (38) found that junior and senior high-school pupils receive but little guidance in magazine reading. More encouraging facts have been found by other investigators. For example, studies by Rinehart (70) and Cox (10) showed that high-school seniors in Pittsburgh will read good literature if the supply is adequate. A study by Elder and Carpenter (23) also showed a growing appreciation among girls for the better types of literature.

Three reports relating to the reading interests of young industrial workers are very illuminating. Rasche (68) found that their interests related all too largely to questionable themes. Metz (53) found that the quality of their interests improved and the amount of reading increased under tactful

guidance. Ormsbee (62) found that one-third of a group of five hundred young employed girls, made up largely of retarded pupils not interested in school, were reading trashy stories. She recommended more careful direction and supervision of their reading activities.

Studies of the reading interests of college students by such investigators as Bloom (7), Beaumont (5), Clark (9), and Turk (82) indicated wide reading of desirable types of literature. It is natural to expect superior types of interest from highly selected groups.

Studies among various groups (59, 28, 36, 40, 48, 57, 73) provided a cross section of the reading interests and habits of adults. To a surprising extent the interests exhibited were superficial and attached to less desirable types of literature. In fact, the investigations at all levels emphasized the need of far greater attention to the stimulation of desirable reading interests and the elevation of reading tastes among both children and adults.

### **Remedial Cases in Reading**

Notable progress has been made during recent years in the study of remedial cases in reading. Among the facts emphasized in the findings was the danger of neglecting poor readers. For example, Blanchard (6) pointed out that if reading deficiencies persist over a period of time, a feeling of inferiority develops which often results in personality and behavior deviations.

The kinds of reading difficulties encountered by children and adults have been described in various terms by different investigators: Monroe (55) defined the types of errors made in pronunciation, such as faulty vowels, reversals, and omissions. Baker (4) and Dougherty (21) used the scores on reading and other tests as indexes of deficiency and interpreted their significance. Albright and Horning (1) described the types of errors made in interpretation by college students. The six major classes were defined as follows: inability to associate the related elements of context; inability to isolate the elements of an involved statement in the context read; failure to grasp or retain from given explanations the ideas essential to the understanding of concepts presented later; failure to see the setting of the context as a whole; inability to fully understand the question; irrelevant responses. Sister Mary Grace (50) identified the chief deficiencies, such as errors in the mechanics of reading, a limited sight vocabulary, a narrow span of recognition, and described the causes in so far as they could be determined. Leland (45, 46) adopted essentially the same plan. These studies resulted in valuable information. They showed clearly that deficiencies develop in practically all phases of reading and are due to many causes. To the extent that the psychological causes of deficiencies can be identified, corrective and remedial training can be provided intelligently.

Much attention has been given to non-readers. Dearborn (17) attributed the difficulties of many non-readers to two conditions; some are handi-

capped by reversals in the form of certain letters and words or parts of words; others are handicapped by "alterations in the correct sequence of letters or in outlines of word forms and the substitution of incorrect elements in reading and writing." Arthur (3) defined several types of non-readers, such as those who are too young mentally to profit from reading instruction; those who are mentally competent and receive good instruction but fail because of physical handicaps; those who are normal mentally and physically but fail to profit from instruction because of emotional factors; and those who seem to have a specific reading deficiency. She also outlined steps taken in efforts to distinguish those who have a specific reading deficiency from other non-readers.

Among non-readers, cases of congenital word blindness are often reported. Ford (25, 26) distinguished them as follows; normal or near normal intelligence, inability to read words although musical symbols or numbers can be read, and ability to profit by instruction in reading. Ford agreed with Blanchard concerning the danger of neglecting such cases. Orton (63) attributed specific reading disability, namely, *strephosymbolia* (twisted symbols), to some non-readers whom he studied. According to his explanation, this type of disability is not generically related to general mental retardation; "it is explainable as a variant in the establishment of the physiologic lead in the hemispheres rather than as a pathologic condition and, as a corollary of the latter view, that proper methods of retraining, if started early enough, may be expected to overcome the difficulty." It is highly desirable that additional studies of the nature and causes of serious reading deficiencies be undertaken in order that the training needed can be more intelligently planned.

## CHAPTER II

### Handwriting

THE extensive advocacy of manuscript writing and the rather wide experimentation in the schools with this style of writing, create a demand for scientific evidence concerning its suitability. Ex parte statements of the supporters of manuscript writing concerning its beauty, legibility, and speed, have been discounted because they have not been supported with data from completely described experiments. Important questions concerning manuscript writing in comparison with cursive, are the ease with which it can be learned, its attractiveness to children, its legibility, and the speed with which it can be written. The two main practical questions concerning it are, first, whether it should be introduced into the first two or three grades and then changed over to cursive writing; and second, whether it should be introduced at the beginning and retained as a permanent style of writing.

#### Studies of Manuscript and Cursive Writing

An early experiment by Reeder (98) sought particularly to determine whether fourth- and fifth-grade children could learn to write manuscript writing with a speed equal to the norm. Several fourth- and fifth-grade classes practiced for three days a week from January to April in attempting to speed up their manuscript writing, and three fifth-grade classes made a similar attempt with cursive writing. Rather paradoxically, the manuscript group gained more in speed and the cursive group gained more in quality. Neither group was up to the norm in speed at the end of the period though the manuscript group was more nearly up to it. The manuscript group was somewhat superior to the cursive group in quality. This somewhat paradoxical result in reference to speed was contradicted by later experiments.

A study of the legibility and speed of the writing of pupils in a practice school using manuscript writing and of the parallel group in general public schools from grades two to six was made by Turner (100). Legibility was measured by reading the writing in a mirror in order to slow down the reading sufficiently to make it measurable. Mirror reading slows down the reading and makes part of it letter-by-letter reading, and therefore, emphasizes letter legibility as contrasted with word legibility. This procedure naturally favors writing in which the letters are separated. Turner found that the manuscript writing was read at the rate of about 1.4 words per second and the cursive at 1.1 words per second. Similarly, she found that meaningless combinations of consonants could be read in a tachistoscope with fewer exposures in the case of manuscript than of cursive writing. In speed, the manuscript writing was faster up to grade five but the cursive

writing passed the manuscript writing at grade six. The cursive writing increased in speed regularly up to grade six, whereas the manuscript writing did not increase beyond grade four.

A third experiment by Gates and Brown (90) gave rather definitive answers to some of the important questions. A comparison of the learning of manuscript and cursive writing during the first year indicated that the pupils wrote manuscript writing of a somewhat better quality than the cursive writing and that they developed a considerably greater initial speed in manuscript writing. The difference in speed was largely due to the fact that the speed in cursive writing did not begin to increase until about a month and a half. In the second part of the experiment, a comparison was made between the manuscript and cursive writing of pupils from grades two to six who were given intensive training for the purpose of increasing the speed of manuscript writing. During the training they did not use cursive writing except very incidentally. At the end of the period the pupils in the first three grades wrote manuscript writing with somewhat higher quality than cursive writing and with much higher speed. In the fourth to the sixth grades the quality of the manuscript writing was also somewhat superior, but the speed of the cursive writing, in spite of the fact that cursive writing had not been practiced, was definitely superior. In a third experiment a comparison was made between the gains of two sixth-grade classes, one of which practiced manuscript writing from February to June, and the other cursive writing for the same period. The two groups gained about the same amount in quality, but the cursive group gained twice as much in speed. At the end of the period, when writing at maximum speed, the cursive group wrote 111 letters a minute with a quality of 10.55, whereas the print group wrote only 94.2 words a minute with 10.3 quality. In other words, the manuscript group could not speed up as much as the cursive group and when it did attempt to speed up it was at a sacrifice of quality. An inquiry regarding the interest in the two types of writing indicated that pupils in the first two grades favored manuscript, whereas in the upper grades there was no marked difference. In a brief supplementary experiment it was found that pupils in the first three grades, who had had only manuscript writing, could shift to cursive writing and in three weeks gain about half the difference between their manuscript and their cursive writing.

Winch (101) made a series of six experiments to measure particularly the effect of changing from one style of writing to the other. In three of the experiments the change was made from manuscript to cursive writing; in one, from cursive to manuscript; and in two, from manuscript to a joined manuscript style. The experiments were made mostly in the upper grades from the fourth to the seventh. In most cases there was a loss in speed as a result of the change. In the only case in which the change was made in the second or the third grade, however, greater facility was attained in the new method. When the change was made as early as the fourth grade the



new method was either more rapid or nearly as rapid as the old. The general conclusion was that if the change is to be made, it should be made early.

A detailed analysis of the movement used in manuscript and in cursive writing gave some basis for the interpretation of the results of tests. Gray (91) made an analysis, by means of the motion picture, of the manuscript and the cursive writing of ten adults, all of whom used both styles of writing, and of the manuscript writing of ten children with the cursive writing of ten other comparable children. The hand position and the general character of the movement did not differ markedly in the two styles of writing. The chief difference lay in the details of the execution of the movement as indicated by the analysis of the speed changes. This analysis showed the effect upon the movement of the numerous liftings of the pen required in manuscript writing as compared with cursive writing. The effect of these liftings, in general, was to reduce markedly the speed of the writing. This difference is the indirect result of the fact that in manuscript writing the strokes are separated, whereas in cursive writing they are connected. Negatively the difference is not due to any difference in the rapidity of the movement of the pen through the air rather than across the paper. It is, however, due to two facts: First, this connecting of the strokes produces a greater number of pauses in the movement; second, the individual strokes of manuscript writing do not attain as high a speed as do those in cursive writing. The continuation of the strokes in cursive writing makes possible a higher speed in the middle of the stroke than is possible with the disconnected stroke of manuscript writing. In other words, manuscript writing is produced by a drawing movement which is frequently separated by pauses.

This analysis by the motion picture explained the result found by tests. A rather slow drawing movement with numerous pauses at the beginning of the strokes favors the production of accurate forms and, therefore, a highly legible style of writing. In the earlier years this style of writing does not hinder speed since all of the child's writing is somewhat of the same character. The child has not yet developed the coordination necessary for the fluent cursive writing. Cursive writing is still somewhat of the character of drawing. As he develops the rhythmic swing of cursive writing in the fifth or the sixth grade and above, however, cursive writing begins to draw away from manuscript writing in speed and fluency until in the adult the difference is very marked. The older child or the adult, as shown by Conard and Offerman (88), may readily develop manuscript writing, or may use it for the production of certain effects, but manuscript writing cannot be written as rapidly as cursive writing without sacrificing its essential merits.

### **Writing Movements and Writing Ability**

A new study of changes in pressure and speed of writing made with the Kræpelin writing balance, following earlier studies made with adults, was made upon children by Kircher (92). Kircher reported a number of detailed findings on the effect of practice, the effect of writing letters in a series

or separated from one another, on the effect of age, and on the differences between good and poor writers. The findings were more largely of theoretical than of practical interest. Some light was thrown on the nature of writing ability and upon the factors which determine individual differences in writing by the Kramer and Lauterbach (93) study, showing that there is some resemblance between the handwriting of twins, at least in so far as general quality is concerned; by the study of Broom, Thompson, and Bouton (86) to the effect that some sex differences in handwriting occur as indicated by the fact that untrained observers can distinguish the sex of writers in two out of three cases; and by Wittler's (102) findings that there is a low correlation between the quality of handwriting and I.Q. but a negligible one with anatomical index.

### **Mirror Writing and Left-handedness**

The explanation of mirror writing is of significance for teachers, both because the treatment of mirror writing presents a practical problem, and because mirror writing is related to the problem of left-handedness, and this in turn to abnormalities in reading and in speech. An excellent review of the literature in the field of mirror writing, together with a good bibliography, was contributed by Blom (85). A general discussion of the divergent points of view was presented by Critchley (89) without, however, contributing any new information on the subject. Pantalone (96) described some case studies and Nepokoj (94) advocated bilateral training in both reading and writing. Scheidemann (99) described tests given in a class of thirty-four children where sixteen wrote with their left hand. On the basis of the tests he advised changing over a number of pupils to the use of the right hand.

### **Analysis Underlying Method and Curriculum**

In order that the teaching of handwriting may be made as specific as possible, it is desirable to know what are the most prevalent faults. Two studies have thrown much light on this question. The first by S. L. Pressey and L. C. Pressey (97) was an elaborate analysis of the illegibilities in letter forms occurring in the handwriting of children and adults. The second study by Newland (95) made a similar analysis of the illegibilities occurring in writing the numerals. The application of these studies is obvious.

### **Abnormalities in Writing**

Two studies were reported which bear on writer's cramp. André and Salavert (1) reported an analysis of the physiological condition which characterizes writer's cramp. Callewært (87) reported a study which is of more immediate interest to educators. He found that writer's cramp may be described as a faulty motor habit occurring in hyperkinetic and emotional individuals, that it can be overcome by treatment and re-education, and that it may be prevented, at least in part, by adopting a position and using a method which emphasizes free and relaxed movement.



## CHAPTER III

### Spelling

CAREFUL compilation places the number of published studies of spelling in the United States from 1882 through 1930 at 625. Of these, 59 appeared between 1882 and 1902 (*Poole's Index*); 23 additional ones, in the years from 1900 to 1909; 139, from 1910 through 1919; and 404, in the years of 1920 through 1930. One hundred and fifty-eight of these 404 studies and articles appeared during the years of 1928, 1929, and 1930. Of these 158 articles, 7 were published as doctor's dissertations, 34, as master's theses, 25, in yearbooks or bulletins, and the remaining 92 appeared in magazines. One hundred and seventeen of the 158 articles dealt primarily with the method of teaching or the psychology of spelling, 2 were annotated bibliographies, and the remaining 39 were concerned with vocabulary studies and testing. Of the 117 articles dealing with method, 15 presented problems of high-school and college teaching.

The studies published in the three years surveyed in the present report illustrated well the present tendency toward inclusion of objective data in published articles. Seventy-eight or 67 percent of the 117 articles dealing with method were based upon controlled investigations. During the period between 1900 and 1928, out of 252 articles dealing with spelling in elementary schools only 84, or 33 percent, included objective data (159: 1).

The present summary mentions 57 studies selected from the 158 articles reviewed. Twelve of the 158 articles had some part of the data duplicated in more than one report. When such studies are included here, the most accessible source is given. This review does not cover master's degree theses. The most comprehensive bibliographies in spelling yet appearing have been published during 1928, 1929, and 1930. The first of these by Sisters Irmina, Visitation, and Gabriel (129), contained 296 annotated references; a supplement by Foran and Rock (119) has since appeared, which added 111 references to Sister Irmina's compilation.

#### Content of Word Lists

Breed (110) presented again the question of whether words of high frequency used only by children should be included in spelling lists. He analyzed a comparison of a composite of investigations of adult correspondence with one of children's writings. Shambaugh and Shambaugh (147,148) reported an investigation showing a marked deficiency in standardized lists compiled from adult sources of the words of richest association in the daily life of children. They used an association test in compiling data and reported their conclusions on the basis of words written in response to the key

words. Horn (127) discussed the shortcomings and values of the association method of studying vocabularies and its place in the technic of future vocabulary research. The *New York State Spelling List* (138) was based on a new compilation of words, while Breed (111) published in a text on the teaching of spelling a vocabulary of 3,481 words, giving their frequency in the eleven adult and five child lists in which they have appeared. Selke (145) reported an analysis of ten spellers published from 1923 to 1927. He pointed out the discrepancy in word lists and grade placement, although the same investigations were supposedly used as a source of words. On the college level, Witty and Fry (158) reported the correlation between college students' reading and writing vocabularies to be very low, with over four-fifths of the written vocabulary falling within the first one thousand of Thorndike's word list. McKee (135) reported a new list of approximately one thousand words needed by college students. Farrar (116) concluded after a study of the words peculiar to the south, taken from Horn's list of over 19,000 different words, that there is no need for sectional spelling lists. Garrison (120) mentioned the Peabody word list to be published soon, compiled from children's written vocabulary of over two million running words. Foran (118) offered a critical review and a summary of the studies of adult and of children's vocabularies.

### **New Type Tests**

Foran (117) believed that recognition types of tests, i. e. multiple choice, error checking, or error checking and correcting tests, were generally less valid than recall tests, such as list, modified sentence, sentence, or completion tests. Guiler (124) found error correction tests, which he designated as written recall, more effective than either multiple choice or oral recall (list tests). Breed (112) likewise found much higher validity for error correction than for multiple choice types of tests. Pintner, Rinsland, and Zubin (141) pointed out the need for a self administering group test of ability in the recognition of correct word spelling, and presented data on the validity and reliability of two such tests, using the Morrison-McCall modified sentence form of test as a criterion for validity.

Several studies were concerned with the construction of spelling scales. Buckingham (113) reported experimentation in a short method of standardizing test material of unknown difficulty by checking the difficulty of unknown words against the difficulty of known words. Wallin and Coles (154) advocated a phonetic spelling scale to measure inherent spelling capacity as a predictive measure of potential spelling ability and reported their method of constructing such a scale. Two studies, Wilson (156) and Wilson and Parsons (157) criticised the selection and distribution of words in the *Stanford Achievement Tests*, Forms V and W, and in the 1928-29 test spelling of the nation-wide testing program of the Public Schools Publishing Company, respectively.

## Generalizations and Rules

Mendenhall (137), after making a study of the characteristics of spelling errors based upon a study of approximately 280,000 words, advocated a visual method of instruction based upon the common errors. Sartorius (144) analyzed about four thousand selected words phonetically and visually, and examined the spelling rules now included in texts in spelling together with the application of the rules to the words of the texts, classified the most common types of errors made on the four thousand words, and estimated the number of words which could be affected by each type. Book and Harter (109) reported an extensive classification of spelling errors.

Carroll (114) used spelling as a means of discovering the comparative ability of bright and dull children in generalizing. He analyzed and classified the errors resulting from the attempts of children to spell unfamiliar words. Archer's conclusion (104) that generalization takes place and therefore should be guided, followed an investigation of the effect of the study of words upon other words both similarly and dissimilarly constructed and upon derived forms. Archer (105) likewise reported the result of an experiment with the teaching of a spelling rule and believed that *how* a rule is taught is as important as *what rule* is taught. Ashbaugh's investigation (106) gave the results of a study of the extent to which the initial error in the spelling of a word appears in later misspellings. Horn (125, 126) tried to correct the assumption that past spelling experiences necessarily transfer, in a desirable manner, in the learning of new words and pointed out the difficulties in the way of simplified spelling, while Trowbridge (153) described an experiment in the teaching of rules to high-school pupils. Masters (132) in a careful study found that four of the most used spelling rules apply to but few of the most commonly misspelled words from a five thousand word list and vary considerably in value to the words to which they do apply.

## Diagnosis and Remedial Teaching

McGovney (134) and Palmer (140) analyzed and compared the abilities of good and poor spellers of high intelligence. Book (108) gave a summary of the diagnosis and detailed treatment of a single case on the elementary level. Guiler reported the methods used and results obtained with college freshmen (123) as well as with elementary pupils (122), and Otto (139) reported the results of a controlled experiment with a small group of selected children. Abernethy (103) conducted a very suggestive investigation of the relation between method in learning to spell and efficiency in learning as indicated by photographic records of eye movements, utilizing the laboratory techniques developed in reading studies. McLeod (136) used spelling as a medium to study the interrelations of speed, accuracy, and difficulty. Kay (128) reported the results of a study of the relationship

between ability to pronounce and to spell words. Sister Visitation (131) added further data on the relation between certain types of visual perception and ability in spelling and reading.

### **Methods of Teaching and Results**

Zyve (159) added data to that already existing in favor of teacher directed, context teaching of spelling and advocated increased attention to the visual form of the word. Steinberg (149) in a less extensive study found results favoring the individual study method. Senour (146) contributed data bearing on the test-teach-test method of teaching, and Phillips (142) presented that from a teach-test-study plan. Distad and Davis (115) found a greater learning of the meaning of words in sentence than in column dictation, while Washburne and Morphett (155) gave a simple technic for discovering the extent to which children know the meaning of words with a view to omitting those not known to the majority. Bayles (107) and Goodrich (121) reported an experiment with various methods of correcting papers by sixth-grade children. Tireman's investigation (152), the first extensive one of the problem, showed a negative value in the marking of "hard spots" in spelling words.

Survey studies tended to show dissatisfaction with the results of spelling teaching. An important one is that by Thompson (151) who studied the effectiveness of spelling instruction by comparing the actual and possible gains in the elementary grades. Two investigators are concerned with the effect of summer vacation on spelling scores. Otto (139) gave data from a small group in a study already mentioned, while Sister Irmina (130) reported the change over summer in a study of approximately eight hundred children. Rogers (143) gave statistics from a survey of thirty-nine elementary schools in Chicago, while Stoddard (150) made available survey statistics of the high schools of Iowa. Bearing on this same question is McCowen's (133) survey of pre-service training for the teaching of spelling in twenty-three normal schools and teachers colleges.

### **Conclusion**

This survey of the studies published in the field of spelling during 1928, 1929, and 1930 indicated a dissatisfaction with the results of spelling teaching as now carried on, with resulting careful and exhaustive studies of spelling errors, and of the extent of generalization in spelling learning. The investigations indicated a marked interest in new types of spelling tests and a continued desire to have reliable results from various methods of the teaching and the learning of words. For the first time inclusive annotated bibliographies appeared in the spelling field.

## CHAPTER IV

### English Language

THE purpose of this review is to summarize the most significant objective studies in the *Psychology of English Language* published from January, 1928, to June, 1931. Several master's theses are omitted on account of the lack of data.

#### Summaries of English Studies

Before January, 1928, no comprehensive summaries of research studies in English were available. Since that time six summaries (195, 201, 200, 203, 178, 206) have been made which are worth the attention of the research worker. However, there will be found a large amount of overlapping in these six presentations. Lyman (195) has made the best and most comprehensive summary of the outstanding research in English language, grammar, and composition up to 1928. The National Education Association Research Division (201) collected for the curriculum worker a short review of some research in English, together with a good list of reference materials and available published teaching aids. Miles and Leonard (200) reviewed 25 significant studies in language and literature. Powers (203) gave a scholarly review of 105 studies on the theoretical angles of the psychology of language learning. Harap (178) summarized the most common grammatical errors shown by 33 investigations. Specific illustrations of errors classified by parts of speech as well as sources are listed. Rudberg (206) studied the main tendencies of research in the linguistic fields of high-school English and reported those investigations which seemed to him to be of greatest significance. Lyman (196) reported to the National Education Association on the significant features of curriculum revision in the field of English.

#### Content and Organization of Curriculum

Rodgers (205) studied the errors made by 29,000 Los Angeles junior high-school pupils in free composition writing. Eighty-two percent of the errors occurred in twenty-four types, the most frequent ones being failure to capitalize proper nouns and proper adjectives, the misuse of *shall* and *will*, and the wrong form of verbal contractions. No significant correlation seemed to exist between the grade level and the number of errors made or between I.Q. and the number of errors made. Leonard (193) studied the capitalization and punctuation errors in a select group of eighth- and ninth-grade children. Most of the errors (54 percent) seemed to be made in the use of parenthetical commas, series commas, terminal question marks, and



the apostrophe of possession. There was also general difficulty with beginning capitals and the capitalization of proper nouns. There seemed to be no consistent growth in punctuation ability from grades eight to nine. Guiler (177) studied the capitalization ability of 649 high-school graduates. He found them to be no better than the average eleventh-grade pupil. The group was far apart in ability, and 14.8 percent of the pupils were below the ninth-grade norms. Six kinds of errors accounted for 50 percent of the total mistakes made.

Symonds and Lee (218, 219, 220) made a series of three studies to determine the way children learn to express themselves in writing as they progress through school. They studied the punctuation, capitalization, and vocabulary in 616 compositions which had been written by children from the fourth to the twelfth grades. The compositions had been rated previously on the *Hillegas Scale*. The authors showed by graphs the progress of learning through these grades and gave significant tables for curriculum builders showing the frequency of usage omissions and errors by grade. These studies throw considerable light on the nature of learning in different phases of language. They discovered that the amount of punctuation increases with the quality of the compositions, but that the gross use of capitals decreased; the use of the comma with the non-restrictive clause develops late; habits of capitalization are learned early, but the distinctions upon which these habits are based come later, and errors with proper nouns are not serious after grade eight.

Symonds and Daringer (221) studied the same compositions for errors in sentence structure. The weak, broad, or divided reference of pronouns was the most common error. Vaguely related causes and comma blunders also constituted a common consistent error. In general, an error tends to maintain the same relative position throughout the junior and senior high school. Ummel (227) studied the errors found in the free compositions of junior high-school pupils.

Spray (212) studied the frequency of grammatical errors made by South Bend, Indiana, children in the third, fourth, fifth, sixth, and ninth grades. Her results, based on an analysis of 1,016 ordinary classroom compositions, are as follows:

(a) Punctuation and capitalization errors account for 70.6 percent of all errors made; (b) punctuation errors alone account for 48.7 percent of all errors made (terminal period supplying 28.6 percent of these); (c) comma errors amount to 16.0 percent of the total; (d) capitalization errors, 22.0 percent (beginning capitals the most frequent one here); (e) verb usage, 5.2 percent. These and errors with the apostrophe persist throughout the grades. Fifth- and sixth-grade children made more errors than those in the third grade. From a study of the ninth-grade compositions, one may conclude that a large number of errors prevalent in the junior high school are also present in the senior high school.

Sullivan (216), Eason (173), Stoddard (214), and Holy (182) tried to ascertain the achievement in grammar and composition mechanics of

the high-school students of North Dakota, Tennessee, Iowa, and Ohio, respectively. All agreed that the language abilities of high-school graduates are low and require remedial attention. Both Holy and Eason found the city children superior to the rural children. Eason endeavored to account for the disabilities of the high-school graduates of Tennessee by studying the qualifications and working conditions of their teachers. He found little correlation between the composition abilities of the students and the qualifications of their teachers. He discovered a correlation of .405 between the students' composition achievement rating and their I.Q.

Harris (179) made a study in the elementary school which is of interest to high-school teachers. She examined the structural elements in the language of the reading materials and the written compositions of children in the first six elementary grades to determine the development of language ability during these years. She found that certain characteristics of the structural elements of the language used are indicative of periods in the development in reading and in written composition. The development of ability in reading proceeds at a more rapid rate and, if judged by the same standards, reaches a higher level of maturity than the ability in written composition by the end of this period.

Berry (163) studied the relative effect of high-school English on success in college. He found practically no correlation between the high-school entrance units offered in English and success in college. It made very little difference in achievement in college English whether a student offered three or four entrance units in English. Vaughan (228) found that the senior year of high-school English articulated very poorly with the freshman year of college English in twenty-one state supported colleges. Talbott (225) examined the records of one thousand students entering the University of California over a three year period. No significant relationship was discovered between English and other high-school subjects. He also found that the relative amount of English taken in high school had very little, if any, effect on success in the *University of California English Examination A*.

Werner (229) investigated the influence of the study of modern foreign languages on the development of abilities in English. He concluded that one could not defend the statement that the study of modern foreign languages would aid in the development of English abilities.

Symonds (224) has thrown some light on the question of the value of formal grammar in improving English usage. While his investigation was primarily a learning study, and will be reviewed as that later in this article, he found the teaching of the formal rules of grammar to be profitable only for superior children who are able to generalize. From his study of the same problem Summers (217) found a correlation of .466 between knowledge of formal grammar as measured by standard tests and ability to write correct compositions. He discovered a correlation of .588 between a knowledge



of practical grammar as measured by standard tests and ability to write correct compositions. These studies re-emphasize the importance of studying only functional grammar in the high school. Rivlin (204) undertook to determine what is functional in grammar by asking English experts to rate the various items of grammar chosen by him for investigation. His dissertation is one of the most important studies of this problem and gives the research worker a long list of the elements of functional and non-functional grammar with the rating of their importance. He also gave a list of the grammatical words which cause the greatest difficulty. The study gives a good review of the changes in attitudes of various English committees on grammar and an analysis of the space given in textbooks to various items of grammar. Leonard (192) studied the grade placement of functional grammar in the junior and senior high school.

The question of class size in English was studied by Smith (210) and Kurtz (191). After a two year experiment, Smith found that pupils in small classes (twenty pupils) did better in letter writing, but that large classes (fifty pupils) were better in the amount and variety of activities in reading and literature. Her study failed to give much consolation to the individual who believes that English classes must be small in size to be effective. Kurtz's classes of thirty-nine pupils learned as much in composition as his classes of eleven, even though they received less individual attention.

Matravers (198) presented a core of essentials of the most socially useful corrective language forms. Stenographic reports of out-of-school conversations furnished the data. His index of social utility was found for each form on the basis of its frequency for every 10,000 words. He listed, with their social utility index, the fifty-four corrective language forms whose misuse is considered illiterate. He showed that the mastery of the first eighteen forms on his list will eliminate 83.2 percent of the total opportunity for errors in the report of conversations and 66.2 percent of the actual errors made. Johnson (186) set up certain English composition standards in conversation and round table discussions on the basis of social value. He listed the opinions of seventy-nine judges on various language conversational traits and of thirty-five judges on discussion factors. He emphasized the value of defining the English composition course in terms of social activities and pointed out the need for standards in connection with such activities.

Commins' (167) study led him to believe that language ability owes a great deal to auditory imagery, particularly that form of ability called glibness.

Poley (202) experimented with pupil test making in précis writing, spelling, punctuation, grammar usage, play study, and poetry. His results indicated that having pupils make their own objective tests was a good learning device. Maloney and Ruch (197) measured the pedagogical value of tests with forty-nine pupils from grades nine to eleven. In their con-

trolled experiment the objective instructional test method produced good learning, being considerably superior to the textbook plan.

Johnson (186) counted the technical words and phrases in English composition books from the lower grades through college manuals. She found that there was a large number of concepts used only occasionally, and that a very small vocabulary of outstandingly important terms was essential. On the basis of frequency plus error studies in English composition, the question being as to terms which were needed to explain to students how to avoid these errors, she made a set of grammatical terminology tests governing this minimal vocabulary for use with high-school pupils to diagnose the deficiencies in language preparation (187). The tests were based on twenty-seven concepts of grammar which she assumed to be minimum essentials. Her test had a reliability of .91 (263 pupils) and showed that remedial work was needed at every grade level.

Stickney (213) constructed, analyzed, and compared recognition-correction and multiple-choice types of tests in language usage. Six hundred pupils in grades seven and eight took the tests. The results showed that the recognition-correction type of test (which contained five more items than the multiple-choice test) was more difficult, took about one-third as long to give, and two-thirds as long to score as the multiple-choice test. There was no difference in reliability. The results seemed to indicate that the presence of a correct sentence with an incorrect one aids the pupil in choosing the incorrect sentence, but at the same time gives no evidence that the pupil has a knowledge of the elements which make the sentence incorrect.

Alvey (160) and Hartson (180) studied the problem of ability grouping in English. In a controlled experiment with equated groups, Alvey discovered that pupils sectioned into special ability groups, compared either on a group or an individual basis, were very little superior, if any, to pupils in heterogeneous groups. The ungrouped plan served the average pupils best. Alvey believed that differentiated instruction is of greatest value to bright pupils and of little value, if any, to dull pupils. Hartson experimented for five years on two plans of sectioning students in English composition—tests and theme writing. He concluded that tests were better than theme writing for this purpose as tests detected 73.6 percent of poor students (measured by final grades), while the theme writing plan detected only 54.2 percent of the poor students. Cooper (168) believed in three group classifications in English based on mental ratings and achievement tests in grades nine and ten, choice of life occupation or previous preparation in grade eleven, and preparation for college or other requirements in grade twelve. He proposed a three track curriculum for four years in English composition and literature.

### **Written Composition**

Daringer (170) studied the forty-one elements and qualities of style of English composition in twenty-five texts to determine how capable these

were of identification in specific compositions. Four thousand and fifty ratings were given by six experienced high-school English teachers. She found fair agreement on the main aspects of English composition which should be taught in the secondary school. The judges agreed most closely on their ratings on variety in the use of words and agreed least on the use of words that were unnecessary. Bushnell (164), using stenographic reports of oral English work, attempted to arrive at an accurate comparison between oral and written compositions on identical material secured from the same pupils. He concluded that written expression is superior to oral expression in thought content and sentence structure and less subject to all kinds of errors. Oral composition is more fluid and incoherent than written composition. Looseness of structure seems to be the most important difference between oral and written composition. Writing and speaking at the secondary-school level are not separate, distinct types. Merits of oral English are practically of the same sort, but not so great as those of written language. The author opposed the belief that one can teach speaking by writing. Chapter one gives some good hints for future research in English.

Symonds (223) had graduate students rate a list of pupils' composition topics for frequency of occurrence and reality. Indexes of importance were then calculated for the topics. The study gave the rating of 48 topics for traditional written composition, 120 topics for miscellaneous forms of writing, and 47 topics for oral composition. The topic, "narration of personal incidents," rated highest as a written composition topic, and "telling a joke" rated highest for an oral composition topic.

Knudsen (190) studied the sources of disagreement among teachers in rating compositions by use of the *Hudelson Typical Composition Ability Scale*.

Scruggs (207) found that teachers rated the same themes lower when typed than when hand written.

Speer (211) took the seven best composition scales, as rated by judges in Kelley's *Interpretation of Educational Measurement*, and evaluated them in terms of the variability of scores assigned to the same specimens by different judges using the scale. The *Nassau County Supplement to the Hillegas Scale* was found to be the most satisfactory and the *Leonard Scale* second best. Hwang (185) discovered the various amounts of variable and systematic errors in rating English compositions. He studied 772 stories from children in grades four to twelve and used ninety-two English teachers as judges to secure a total of 29,600 ratings. He believed that the best conditions for rating English compositions by scales is to rate compositions written on similar topics with a wide range of quality with an objective scale of the general merit type. The best general type was the *Hudelson Scale*, while the *Van Wagenen Scale* was the best of the special merit type.

Huxtable (184) studied twelve hundred letters written by Los Angeles junior high-school pupils of four ability levels to determine the status of

mechanical errors and the quality of thought content present. He found an imperative need for improvement in thought content even among the brightest group. These bright children showed by their success in mechanics the emphasis the English teachers were placing on this phase of English.

Dannettelle (169) undertook to determine objectively the existence or non-existence of the relationship between the oral and written composition abilities of seventy-five Wisconsin college students and junior high-school pupils. The author found a close relationship existing between the general sentence errors of oral and written compositions in junior high school and college. This relationship in college themes was especially marked in ambiguity, but less noticed in errors with parts of speech. There seemed to be some correlation between oral and written English, which is higher for college than junior high-school students; but no correlation was found between mechanics of oral and written English. Speaking and writing are forms of the same mental process in so far as invention and logical organization are concerned.

### **Investigations in Methods of Teaching**

Lewis (194) experimented with the contract plan and the mass instructional plan using parallel groups. Her results seemed to indicate some advantages in favor of the contract plan. Smith (210) worked out a whole set of concrete descriptions of technics which she used effectively in teaching classes of fifty in English language and composition. McAnulty (199) and Horner (183) studied the effectiveness of the laboratory plan in teaching English composition and grammar. Horner concluded that the laboratory plan was "extremely wasteful of pupils' time and energy, requiring nearly double the amount of time and study to accomplish somewhat inferior results." McAnulty, on the other hand, concluded that the laboratory plan was effective in teaching composition and grammar with any size class.

Chiles (166) studied the relative values of teaching English composition with and without models of successful writing. He selected 218 junior high-school pupils and by a rotation experiment taught both groups each way for ten weeks. The results showed an amazing growth in these pupils by either plan. Measured in terms of normal growth from year to year on the *Hudelson Scale*, these children attained an average growth in ten weeks of from twenty to seventy weeks without models and from thirty-six to ninety weeks with models. Such results caused the author to unreservedly proclaim that "the best modern methods of teaching written narrative composition can be greatly improved upon by employing illustrative models chosen from literature of interest to children."

Hasbrouch (181) found the oral or written approach equally effective in teaching sentence sense.

Shekell (208) compared the effectiveness of teaching composition by two methods: (a) having pupils write original compositions upon subjects of their own choice, and (b) having them reproduce stories read by the in-

structor. He used eighty-eight junior high-school pupils and followed them through a period of twenty weeks. From his results he concluded that pupils will improve faster and more uniformly in composition ability when permitted to select their own themes, but a theme will doubtless be of a higher type when the pupils reproduce stories. Ernst (174) studied the use of rules in teaching the writing (spelling) of the present participle form of various words.

Campbell (165) used the individual conference method with junior high-school pupils to determine what reasons lay back of capitalization errors. Her results led her to discredit the somewhat prevailing opinion that such errors occur by chance or are due to carelessness. Capitalizing the words which the children desire to emphasize and singular nouns with definite articles mistaken for proper nouns are typical reasons.

Symonds (222) secured data on the theories of two schools of psychological thought; namely, (a) the school which organizes its teaching into a series of practice exercises with motivation subsidiary, and (b) the school which makes practice a means which is used only when zeal and interest are present. His chief object was to determine the influences of practice and of motivation upon the learning of grammar. Groups of sixth-grade children from eighteen New York City public schools were used as subjects. Some pupils received practice without motivation, some practice with test motivation, and some practice with intrinsic motivation. He concluded that the amount of repetition was more important than the type of motivation, but that the test motivation type was effective in producing greater learning—probably equal to about five sheer repetitions. His study indicated how ineffective are our habits of conjuring up verbally descriptive situations to be used for motivation, and how we may use self-competition to improve the effect of practice.

Symonds (224) later studied the problem of the relative effects of learning grammar by the following plans: (a) practice in analysis of grammatical constructions, (b) choice of correct forms, (c) studying grammar by rules, (d) mere repetition of correct and incorrect forms in succession, and (e) combination of all preceding technics. His results showed that a combination of all five plans for fifteen minutes a day for three weeks produced the greatest learning, showing an estimated gain in these sixth-grade children equal to about three years of ordinary expected improvement. Mere repetition and motivating devices were ineffective in producing gains on the tests used; however, the repetition of right and wrong forms had greater effect on usage than any work with grammar. Analysis of constructions was effective; practice was more effective than learning rules; but the mere learning of rules produced wholly unexpected gains on the grammar test. This transfer, however, was greater for bright children. This study seemed to show that quality of drill is more important than quantity, and learning rules of grammar is valuable only for superior children.



Klopp (189) found that the learning of formal grammar gave no significant power over functional grammar, but that the study of functional grammar produced good results on the formal grammar test.

Rodgers (205), after determining the grammatical errors of 29,000 Los Angeles junior high-school pupils, chose twenty-five cases of four I. Q. levels in each of the six grades studied and had them follow a rigid remedial program of pre-testing and drilling. The remedial work centered on the first five most frequent errors made and continued for three days in each week for three weeks. Her results showed that in three weeks she had eliminated 19.4 percent of the errors. She found nearly constant improvement in all grade groups and nearly uniform improvement in all ability levels.

Smith and Powers (209) sought to discover how sentence learning of vocabulary was possible. Their results indicated that sentence wholes are never handled as such, but are broken into units which are memorized.

Thomas (226) used formal dictation and multiple response types of drill exercises on specific situations to determine their effectiveness on the elimination of technical English errors. He was also interested in determining to what extent this reduction transferred to the same types of errors in the pupils' writing. The results indicated that many errors were reduced by the use of this plan, and that such elimination carried over to written composition work.

Williams (230) compared the ordinary textbook instruction plan of teaching language with regular instruction plus drill exercises. He recommended practice drills for use with dull students but questioned their use with the bright ones. Grimes (176) showed that drill on formal grammatical errors was a more effective means of teaching than the learning of rules.

Dunn (171, 172) in studies of teaching both sixth-grade and junior high-school pupils, found evidence of the value of making the pupils conscious of their own errors and the use of test results for motivation.

Leonard (193) showed that practice exercises are excellent means of teaching punctuation and capitalization in the eighth and ninth grades. The learning by the use of these exercises was well retained six months after the experiment was over and appeared to transfer to the actual composition writing of pupils. This method of teaching has been proved effective and relieves the teacher of much ordinary theme correcting.

Ashley (161) investigated the effect of cooperation between the home and the school on the improved grammatical ability of tenth-grade pupils and their parents. The results showed that the pupils eliminated 9 percent and the parents 11 percent of about eighty commonly used ungrammatical expressions. The experiment proved most valuable in the elimination of errors in number of the verb, wrong form of reflexive pronouns, and misuse of adjectives and adverbs. Average pupils profited most, for experiment showed practically no gain due to the experimental plan in dull and superior children.

## CHAPTER V

### Arithmetic

**D**URING the years covered by this report, problems involved in the teaching of arithmetic have elicited a remarkable amount of research attacks. As would be expected in a quantity of research production, the quality varies from excellent and substantial contribution to an opposite extreme of rather careless and superficial material. There seems to be no question that science is rapidly increasing our control over the various problems of the teaching of elementary-school arithmetic. The studies referred to in this issue of the *Review* are but a sample of all the studies which have been made. It is quite possible that another writer would have chosen another, perhaps longer, list of studies. However, it seemed wise to keep the number reasonably modest so that the reader might not simply lose his way in a thousand-and-one titles.

It is not always easy to decide whether a contribution can properly be classified under a category of the psychology of a school subject or not. Some well-known studies may not be found in this list because, in the opinion of the writer, they are not of sufficient psychological nature to warrant their inclusion. It is also quite probable that the reader will find several titles which do not seem to him to belong properly in a report on the psychology of arithmetic. These are inserted because they are of vital interest.

A report on research in arithmetic in the present volume is of secondary importance, since Buswell (232, 233) in his yearly reports, published in the *Elementary School Journal*, covers this field with well-known efficiency and promptness. In the recent yearbook on arithmetic, published by the National Society for the Study of Education, a generous discussion of research in this field is to be found, and a perusal of new research published in this yearbook is recommended to the reader (234). Brownell (231) has written on "The Technics of Research Employed in Arithmetic," which surveys the field in a substantial way.

The following report on research is classified under ten center heads, which divide the various interests represented in arithmetic in perhaps sufficient detail.

#### Curriculum Construction

Recent years have witnessed considerable activity in renovating the curriculum in arithmetic. Hosts of cities, many counties, and some states have rewritten or reconstructed their courses of study. More thoughtful work in the field of the curriculum has involved careful appraisal of pub-



lished research on the part of the committees, both in respect to the sociology of arithmetic, and the psychology of learning involved. There are many published curriculums of merit and a fair sample of these includes thorough discussions of fundamental principles, many examples of drill exercises and problem units to be used in the classroom, and other teacher and pupil material. (A clear tendency in curriculum construction in arithmetic at the present time is the inclusion of much more detailed and specific material than was formerly included.) Two representatives of this tendency in curriculum construction are the well-known publications from the schools of Denver, Colorado, and the newer curriculum of Tulsa, Oklahoma. These published curriculums as companions to many other excellent curriculums may almost be considered expanded methods books or expanded textbooks because of the practical and detailed manner in which the problems are discussed. The research basis of the newer type of curriculum is becoming constantly more solid and firm. The newer curriculums, in addition to carrying forward the general policy of stripping the pupil's work of needless content, are launching increasingly powerful attacks upon the more stubborn problems of learning, of testing, of making provision for individual differences, of meeting the ever-troublesome problem of forgetting by means of maintenance programs, and lastly, of inserting effective technics for motivating the efforts of the pupils.

Of course, any research in arithmetic could be classified under curriculum construction, but the following references seem to bear with especial directness on curriculum construction: Bowden (237), Buckingham and MacLatchy (239), Laughlin (245), Masselink (246), Swalwell (248), Buckingham (238), and Bentz (236). Other studies which are more particularly concerned with technical problems of learning in contrast to the social utility of the content in general, are as follows: Beito and Brueckner (235), West, Greene, and Brownell (250), Rolker (247), Dale (240), Jeep (241), Kregel (244), Kline (243), Jones and Buckley (242), and Washburne (249).

### **Problems and Problem Solving**

Problem solving is perhaps the most resistive aspect of all tasks in arithmetic. Real problems involve a maturity of reasoning; and it is common knowledge that the deeper arithmetical computations are buried in problem situations, the more difficulties there are present for the pupil. It is obvious to many that our present conventions relative to problem solving seriously overestimate the ability of children to indulge in the types of thinking involved. (Current tendencies relative to problems themselves stress the importance of genuine problems in contrast to academic puzzles.) Many attempts are being made to teach children methods or procedures or perhaps simply tricks by which the problem tangle may be smoothed out before the actual computation is begun. It should be borne

in mind, however, that theoretical psychology is a trifle weak and very much confused in respect to the fundamental theorems involved in the description of human reasoning, to say nothing of the present relative inability of theoretical psychology to control or improve the reasoning process itself. (It is possible that much of the really fundamental work in the field of teaching children how to solve problems is a hope of the future rather than an accomplishment of the past or present.) If attacks on problem solving directed by the *Gestalt* psychology work out in the schoolroom as satisfactorily as some psychologists are willing to promise, then a report on problem solving a few years hence, will contain far more encouraging references than is now possible in the light of sober facts.

A technology of teaching arithmetic, especially addressed to problem solving, is based today, however, on more than zero knowledge. The following references are worthy of study: Kulp (263), Rosse (269), Hanna (258), Adams (251), West (277), Monroe (267), Hanna (259), Chase (254), Brueckner (253), Bowman (252), Sanford (270), Otis (268), Ligda (264), Keener (262), Durell (255), Hyde (260), Van Wagenen (275), Thomas (273), Farmer (256), Foster (257), Washburne (276), Lutes (265), Tyler (274), Stone (272), John (261), Smith (271), Mitchell (266), and Wheat (278).

### Initial Instruction

There is a clear shift of interest in research in arithmetic to include careful inquiry into initial learning. Until quite recently technical work in arithmetic was dominated by the interest in measurement. No doubt improvement in measurement was a first step of great importance. (It is now becoming increasingly evident to workers in the field that we must know far more about the causes of the high and low scores on our measuring tools. Hence, we find a beginning of psychological analysis in two directions, both squarely in the field of initial learning. One type of research is attempting to inquire closely into the content of arithmetic in terms of actual learning difficulty, and in terms of the learning nature of the curriculum. A second type of research is centered around a whole area of problems suggested by the question: Just what are pupils doing as they learn or try to learn new content? Interest in measurement in arithmetic as such, is not decreasing; but another phase of the learning process is appearing, perhaps even more fundamental than that of measurement. It matters little how finely we measure a product if we haven't very much product to measure. (We are trying now to find out the important facts about the arithmetical processes so that we may help the child to learn more per unit of time.) We are also trying to find out more about how children actually do study so that we may improve their efforts in initial learning.) It is only fair to say that research attacks on problems involved in initial learning are far more complex and stubborn than they might

appear at first glance. Real advance has been made, however, in describing arithmetical processes in terms of learning difficulty, and also in examining actual children at work on initial learning enterprises.

In general, it may be said that the processes involved in elementary-school arithmetic are more complicated in their organization than they would appear to be to an expert mathematician not acquainted with the immaturity of elementary-school pupils. It is obvious that many aspects of a process which have for years been taken for granted as sun-clear by the adult are by no means sun-clear to the first learner with his immature mind and his limited experience. The older psychology of arithmetic solved many vexatious problems relative to first learning by either denying their existence or by projecting the difficulty upon the pupil's laziness or undue and unnecessary obtuseness. Learning analyses in whole numbers and in fractions have been the product of the immediate task. Similar investigations into the field of percentage and other areas of notorious difficulty have yet to be perfected or have yet to appear in print.

Among the many useful researches which purport to examine into the learning nature of the processes themselves are the following: Myers (293), Brownell (281), Knight and Behrens (287), Lindquist (288), MacLachy (289), Norem and Knight (294), Olander (296), Washburne and Vogel (301), ReBarker (298), Cushman (285), I. H. Young (305), Wells (302), Price (297), Moore (291), Mahoney (290), and Bogue (280). Other studies closely related to the problem of initial instruction are: Colwell (283), Woody (303), Washburne (300), and Buckingham (282).

Assuming for purposes of classification that the textbook is a learning instrument as well as a drill and problem book, several studies relative to text construction are available. Among these are: Benthack (279), Crofts (284), O'Connor (295), Hagan (286), Schlinder (299), Morrison (292), and C. D. Young (304).

## **Motivation**

The teaching of arithmetic is replete with motivation devices. Exact scientific appraisal of the effectiveness of motivation devices is scant in contrast to the number and variety of devices used, and the vigor of the claims made for each. Scientific support is certainly very small considering the importance of having a solid psychological foundation for the whole problem of motivating arithmetic. It is quite possible that studies listed under different sections of this report might have been listed under the title of motivation. However, space prohibits the listing of a study under more than one title. Within the time with which this report is concerned, Panlasigui and Knight (306) (have an extensive motivation study on the effect of the keeping of one's score on progress made.)

### **Drill or Practice**

Perhaps as solid an advance has been made in the field of drill in the last few years as in any sector of the total arithmetic front. Several divisions of this improvement are obvious. (Drill is now being built according to specification rather than in a random fashion.) It is increasingly evident that sheer amount of repetition is by no means the whole story. Characteristics other than quantity are to be demanded. We find that the frequency with which each number fact appears in drill work is a matter of concern, and various types of drill organization with this point in mind have been subjected to experimentation. The drill provisions of various texts have been studied as have also similar provisions in various practice pads and workbooks. The following studies are representative examples of an effort to provide clearer thinking about the many problems connected with drill or practice: Lutes and Samuelson (402), Repp (405), Myers (403), Benz (308), Bruene (400), Nelson (404), Brueckner (309), Beall (307), Coquillette (401), and Rice (406).

### **Tests and Testing**

A very large percentage of work in the field of testing finds its way into published tests. These exist in most confusing number at the present time and no record of them is needed here since the publishers of these tests furnish the inquirer with ample information about them. (The present tendency in testing, as the writer sees it, is away from the general test for general or vague purposes toward specific tests, which are diagnostic in ambition, if not always in realization.) A second tendency in the test field is to abandon testing as an enterprise in itself and to recognize it as but an element in an organic unity, namely, test and then conduct remedial work as is indicated by the test results. The following pronouncements are indicative of the status of testing at the present time: Greene and Buswell (408), Woody (417), Simpson (415), Sangren (413), Power (412), Lazar (411), Knight (410), King (409), Garrison and Hodgson (407), Wilson and Ashbaugh (416), and Scott (414).

### **Errors and Diagnosis**

Useful studies of chronic difficulties which are widespread and which attempt to understand the causes of these difficulties are appearing in the literature with increasing frequency. In the end such studies of errors and their diagnosis will doubtless lead to far better first teaching and more efficient maintenance programs. (It is obvious that error studies can be used not only for immediate remedial work for pupils who made the errors, but to the extent that the causes of the errors are understood they can form the basis for preventive work in arithmetic,) which is perhaps a most important step. It is quite impossible to list all the studies based

upon error counts or error analysis. The next references will give the reader a general view of this field of inquiry: Lang (425), Coit (421), Brueckner (420), Anspaugh (418), Brueckner (419), Coit (422), Osburn (426), Waterson and Unruh (430), Turechek and Milster (428), Edwards (423), Hayes (424), Tyson (429), and Suchanek (427).

### **Remedial Program**

Remedial work has always challenged the interest of practitioners in arithmetic. Remedial programs are rapidly being taken out of a rather formless field, which is a mixture of fact and fable, and reduced to an orderly and systematic service. The general principles of remedial work have been outlined in some detail, though, of course, any outline is subject to revision. There have appeared during the last few years various remedial services, some of them directly connected with test services and others without such relation or connection. Certain remedial programs have been described which use the group as the unit. Other programs are strictly individual in their nature. The following are representative of a much longer list of publications: Fowlkes (434), Neal (438), Otto (440), Brownell (431), Gabbert (435), Evans (433), Greene (436), Whitson (442), Trousdale (441), Nifenecker (439), Logan (437), and Eaton (432).

### **Methods**

Very many, if not all, of the precise methods now used in computation have yet to be submitted to searching psychological experiment. No doubt such experimentation will show that a large fraction of our present methods of computation, if not of teaching these computations, is correct, or at least as good as alternative ways of doing the same thing. Arithmetic stands in need, however, of an experimental basis for adding up versus down, or the reverse, as the facts may finally prove to be. In the field of more complicated processes, such as the division of fractions, the various uses of compound denominate numbers, and certainly percentage, most teachers are at the present time acting on no better basis than what custom and tradition have provided for them. Competent investigation relative to methods from grades two to eight is confidently expected. For example, of the many ways in which the primary one hundred addition facts and one hundred subtraction facts may be learned, the bulk of practice at the present time gives clear preference to what might be called the *psychology of authority*, namely, the way for a child to learn that seven plus eight is fifteen is for his teacher to tell him so, and after this information has been imparted, generous amounts of drill should follow. Theoretical psychology, however, is quite willing to challenge the fundamental theory of learning suggested by the phrase, *psychology of authority*. If one were to examine the methods used in the teaching of percentage and then ask himself the question, "How do we know that these are the best methods to use?" the



answers, as far as precise scientific information is concerned, would have to be exceedingly vague in order to keep anywhere within the demonstrable truth. The general field of methods used in computation share with other aspects of arithmetic a genuine need for more and better research.

A considerable amount of work and not a little thinking are available in the field of method and the following references are samples of such research and thought: Ruch and Mead (455), Overman (454), Knight (449), John (447), Foran (444), Morton (452), Brueckner (443), Voorhees (456), Myers and Myers (453), Manuel (450), Mary Irmina (451), Hamilton (445), Herr (446), and Judd (443).

### **Teacher Training**

Problems of teacher training are receiving an increasing amount of attention, and genuine experimental attack is well within the realm of possibility. To date, material relative to teacher training in the field of arithmetic is largely of the discussion type and very little experimental data are available. The following references are either fact-finding in nature or present well-organized opinion of the problems involved: Taylor (459), Buckingham (457), Foberg (458), and Van Walker (460).

### **Conclusion**

The reader should carry specifically in mind the fact that the one hundred and forty references given in this review do not exhaust all the publications which a complete bibliography would include. They are, however, a fair sampling of the production of scholarly thought and work relative to arithmetic during the years with which this report is concerned. It is, without doubt, a much better list than any other three years of educational history could produce to date.

If the writers might be allowed a prophecy it would be this: A first need for scientific workers in arithmetic is a penetrating and thorough-going research on research. At the present time there exists a wide range of inherent worth in the literature basic to arithmetic. A research on research which would cull out publications lacking in merit and put forward in a sort of preferred list those which have genuine worth, would give to the student of arithmetic a compact, consolidated literature which he would be able to master without an undue amount of time or labor. Further, the practical workers in the field would be saved many missteps and misdirections.

During the immediate future it is probable that there will be considerable attention paid to the problems involved in first learning, in maintenance programs, and in procedures which will tend to take the many disparate items of our mathematics curriculum and weave them together into a functionally organic unit. Mathematics is still too much a series of unrelated chapters so far as the typical school child is concerned.



## CHAPTER VI

### Social Sciences

UP TO 1928 the present writer had attempted several appraisals (477, 478, 479, 480) of the learning difficulties of the social sciences—history, geography, civics, economics, and sociology. The evidence up to that time showed the following: (a) a continued emphasis on knowledge and discipline as the chief objectives; (b) partial mastery of the facts commonly presented in these studies; and (c) a relative abstractness of the readings intended to describe for children social life, past and present. In 1928 the writer published his detailed analysis (476) of the content of the traditional social science-citizenship curriculum. Due to the fact that the textbook in these subjects dominates what is taught, it was possible to reveal rather accurately the nature of the curriculum in the social sciences. The relatively impersonal evidence of this survey is the chief basis of this summary, particularly in respect to the main types of approach to the psychology of the subject.

One of the criteria set up for purposes of evaluation in *Curriculum Studies in the Social Sciences and Citizenship* (476) was: To what extent do these social subjects meet the learning needs of pupils? An attempt to answer this question objectively caused the writer to search for the evidence concerning the learning difficulties of the social sciences.

#### Learning Needs of Pupils as Revealed by Tests

*College entrance examinations*—The earliest type of evidence available is found in the results of the systematic entrance examinations reported annually by the College Entrance Examination Board. At the time this evidence was collected (1923) by the writer the data showed, during the period of 1919-23, that only 40 percent of high-school graduates taking the examinations in American history made a passing grade (between 60 and 100 percent); in ancient history the percentage was 46.4; in civil government, 50.1; and on the comprehensive examination, 32.7 percent. We do not perhaps know accurately the ability of high-school seniors; yet some specialists in the field of intelligence, notably Terman and Proctor, assert that the I. Q. of secondary pupils is above 110. One can certainly conclude that a large proportion of pupils, many of them capable of good work, fail to satisfy standards of attainment set up in the field.

*Standardized tests*—As implied in the preceding paragraph, actual learning can be best verified by test results. Within the past fifteen years considerable progress has been made in the formulation of relatively objective standardized tests in the social sciences. Space permits the citation of but

two such studies to emphasize the typical testing outcome. A pioneer standardized test prepared by Bell and McCollum (464) on very simple associational facts in United States history showed that (a) upper-grade pupils ("covering" this field once) could answer but 15 percent of the facts called for; (b) high-school pupils (after a second year of study on content largely identical with upper-grade American history) mastered only 33 percent of the facts; and (c) college sophomores (after three "exposures" to this content) knew but 49 percent of the facts—less than half learning after three years on content largely similar in character. Dean (467) more recently constructed a test, restricting his questions in the fields of geography and history to facts that scientific curriculum studies revealed as high in social utility. This restriction to facts one commonly meets chiefly in one's reading of periodicals again showed partial mastery as follows: (a) ninth-grade pupils, 47.9 percent; (b) twelfth-grade pupils, 65.4 percent; and (c) junior-college students, 64.8 percent.

*Ability to comprehend the reading materials in one social science*—Ayer (461) turned to the nature of the reading process in her testing program for fifth- and seventh-grade history. She found, after obtaining scores of the pupils on the *Thorndike-McCall Reading Scale*, that a child with a normal fifth-grade reading comprehension could answer only 12 percent of the questions based on original paragraphs and but 26 percent when the paragraphs were simplified; similarly a seventh-grade pupil with normal seventh-grade reading ability could answer only 31 percent of the questions on the original paragraphs and but 44 percent when the paragraphs were simplified.

*Mastery of concepts*—It is at least a hypothesis that terminology may handicap learning. Meltzer (472) determined socially valuable words or terms encountered in reading in life outside the school. Then he tested children for comprehension of these "key" words in the social sciences. Here also test results showed low mastery. The confused, erroneous, and "don't know" answers constituted 51.39 percent of the entire field. If one added "correct facts but no general idea," this total became 74.1 percent. In contrast, only 26 percent of the answers were either reasonably correct or superior and but 5 percent were found to be superior answers.

*Ability to comprehend graphic and pictorial materials in the social sciences*—Besides the typical textbook materials there are other means of presenting social and economic facts. Mathews (471) tested children from the fourth grade through the twelfth grade for comprehension of dramatic episodes, maps, graphs, pictograms, and time lines. His evidence also showed limited attainment in the comprehension of facts implied in even graphic-pictorial content—an average of 15.3 percent in the fourth grade, 54.4 in the eighth grade, and 72.8 in the twelfth grade.

*General interpretation of test results*—Various types of evidence clearly confirmed the conclusion that pupils on any level of public education

achieve but partially the commonly claimed objective of knowledge; and, as we shall point out subsequently, there is little evidence as to the attainment of other objectives. Here, without further reference to what should be the attainment of pupils in all objectives, we shall turn to what analysis of the present reading curriculum in the social sciences reveals as to possible difficulties in learning.

### **Hindrances to Mastery of Content**

*Vocabulary difficulties*—Several studies (474, 463, 472, 476) of the vocabulary of the social sciences have been made. There is considerable evidence concerning the relative frequency of place locations, persons, events, dates, topics, and their appropriate space allotments. The data showed a tremendous range of terminology with slight attention to principles of repetition and with almost no recognition of the socially valuable facts. The vocabulary study by the present writer (483) suggested apparently one difficulty. It is at least a theory that words infrequent in occurrence may cause difficulty (474). An analysis of a sampling of the words (terms) in four social science books revealed about 4 percent of them in upper-grade textbooks to be infrequent (above 4,000 in Thorndike's *Word Book*) and over 9 percent in senior high-school texts. Consider possible comprehension difficulties when, on a typical 350 word page, from 14 to 30 words are relatively infrequent. Also analysis revealed almost no attention to explanation in simpler words of even the first use of a technical vocabulary.

*Other reading difficulties*—Three may be mentioned and illustrated: (a) Difficult technical words—"Because Friends speak only the truth, they do not take an oath. In courts of law their simple word is as good as an oath"; (b) long involved sentences; and (c) abstract thought—"In the year that Louis XIV was crowned there was born at Rouen, an old town to the northwest of Paris, a boy who was to place the French flag in the Mississippi Valley."

*Too many facts implied*—Analysis of the content of the social science textbooks revealed too many difficult facts. These textbooks are organized on a systematic, logical, comprehensive basis; each attempts to "cover" the field. A typical text in geography mentions over 500 place locations; one in history 250 dates, and scarcely 30 of them are common to all textbooks in the field or are mentioned sufficiently often to assure mastery by repetition. The research showed wide variations as to these socially important data (476). Moreover, the context is rarely simple enough to fix the desired associations. Finally, it should be pointed out that relative values are ignored. Unimportant facts are not singled out and distinguished from important facts needed in life outside the school. The curve of forgetting is evident also. Brooks and Bassett (466) showed this factor in a controlled experiment in American history. Their data revealed that for-

getting is most rapid during the first four months after the close of the term in which the facts were learned.

*Textbooks chiefly restricted to generalizations of the author*—The small amount of space given to a topic immediately raises the question of how much the pupil can really learn from any condensed treatment. Scarcely more than the conclusions of the author are given. While such conclusions are almost invariably scholarly, it may be assumed that pupils need details from which to conclude for themselves.

*Textbooks not designed to stimulate analysis and reasoning*—As implied in the preceding paragraph, pupils should be given details from which to draw generalizations for themselves. Yet textbooks are descriptive in nature. They attempt to tell students the facts rather than to present evidence or data in such a way that pupils themselves will be forced to analyze, interpret, and generalize for themselves. The dominant knowledge outcome set up as an objective implies memorization far more than reasoning.

### **Contributions of Psychology to Effective Learning**

*Attention to significant objectives*—No one gainsays the value of knowledge of the facts of the social sciences. The issue is: In the time allotted and in terms of social needs, which facts are *relatively* most important? The research dealing with social needs shows that those facts (concepts, topics, and the like) of great value are relatively a small part of the sum total of knowledge or experience in the field. It would follow then that attention in teaching to the more frequent, common, or crucial items should result in improved learning.

There are other objectives, or rather outcomes (473), such as habits or duties of citizenship and attitudes, appreciations, and ideals. While the latter objectives are undervalued at present, reorganization of the social science program must take them into account. In the writer's opinion, any reconstruction calls for consideration of two types of curriculum materials.

*Suggestions for the reconstruction of reading materials*—The work of Harold Rugg and his associates in the Lincoln School offered in some degree both theoretical and experimental evidence as to needed changes in the reading program (484). As implied above language is the nub of learning difficulties. A sound psychology for the reading phase of the social studies-citizenship curriculum suggests: (a) reading materials suited to the abilities of pupils; (b) attention to relative values; (c) an organization which will illustrate by varied graphic pictorial means the essential modes of living, problems and ideals of life, past and present; (d) an organization which will require constant active learning, application of the laws of learning, growth, variation in methods of making the reading meaningful, and attention to concomitant learnings such as attitudes, appreciations, and ideals engendered; (e) planned repetition for the devel-

opment of essential skills; and (f) an organization which will stimulate analysis and reasoning.

The reading materials must be organized first to promote comprehension and grasp of socially valuable facts, relationships, and problems. The work of Ayer, Meltzer, Harold Rugg, and Earle Rugg showed the need of attention to vocabulary, terminology, and a wealth of concrete graphic pictorial materials. Meltzer suggested terminology of social value that should be made meaningful to pupils. Similarly the determination of problems by Hockett (468) and generalizations by Billings (465) in the Lincoln School offered an impersonal basis of "key" objectives for study. Washburne (487), from careful experimental work, gave suggestions as to conditions under which various types of graphic pictorial material may be best used. Space permits us to cite but a few illustrations: (a) the simpler the visual pattern and the fewer the data, the more specific the recall; (b) the paragraph in general is the least favorable method of insuring recall of quantitative facts; (c) a statistical table is the form most favorable to the recall of specific amounts; and (d) the bar-graph is best for recall of relative amounts and the line-graph for relative increase, decrease, and fluctuation. Shaffer (485) in an attempt to evaluate the "generalization" and "episode" types of presenting materials concluded that there is little difference which type of story or sequence is used. Learning will be most economical, however, in response to a problem situation felt by the pupil; and the amount learned is proportional to the number of repetitions which, for the achievement of other broad aims, should be in varied settings. In addition, Shaffer suggested, apropos of broad adjectives, that the materials of instruction should be similar in form and content to the actual objectives.

Other types of problems dealing with the reconstruction of the reading materials include: (a) The problem of individual differences in a class is of special importance. One study by Weaver (488) suggested that formal instruction is of considerable value in teaching pupils below average in attainment and is of little value in teaching pupils of superior attainment. (b) Two studies, by Meltzer (472) and Bamsberger (462) were mere beginnings in the important field of experimental study of the value of comparative hypotheses. Meltzer found in comparing two groups of pupils (one had studied traditional history and geography; and the other the new unified social science course of Harold Rugg) on grasp of his list of socially valuable concepts, that the latter group made a higher mean score,  $124.5 \pm 3.76$  as against  $78.6 \pm 4.32$ , a difference of 45.9 in favor of the latter learning principle, although the number of pupils in each of the two groups was very small. Meltzer also claimed that the difference in intelligence is not sufficient to warrant its acceptance as an explanation of this superiority. Bamsberger compared sixth-grade elementary pupils in a controlled experiment—one group studied an activity type of social studies curriculum, organized in terms of the principles of *Curriculum Making* in



an *Elementary School* (470); and the other, traditional history and geography. In achievement of pupils measured by subjectmatter in the basic textbooks, the former group did slightly better, and in concomitant objectives—establishment of desirable collateral reading habits, outside interests in the community, and constructional activities in the school—again the former group were superior to the latter. In grade placement Mathews (471) gave us data concerning the ability of pupils from the fourth grade through the twelfth to comprehend varying types of pictorial materials. Certainly there is need for more study of the actual grade placement of each unit of work.

*Suggestions for a broader type of activity program*—In closing, the writer, while lacking experimental evidence, would call attention to the need for a broader concept of the social sciences. Both the subjects now classed as the social sciences and the so-called extra-curriculum activities claim citizenship education as a primary objective. In the writer's opinion what is commonly thought of as the social science curriculum should be chiefly designed to give children the proper knowledge and appreciation of the implications of social environment, both past and present; and the extra-curriculum activities, now a vital part of the school program, should provide for much actual practice in the situations and problems of social living. Dewey's ideal of the school as a miniature society may well be the foundation of a new social psychology for pupils both on the elementary and secondary level (481). The implications of original nature, particularly social tendencies such as gregariousness, mastery, approval, activity; the significance of fundamental attitudes, such as obedience, prejudice vs. tolerance, and the like; and ideals of social living are but illustrations of the need of a better understanding of the social psychology of this phase of citizenship education (469).

Finally, it should be said that a bare beginning has been made experimentally to determine the validity of psychological or learning principles in the materials and activities relating to the social science-citizenship curriculum.



## CHAPTER VII

### Mathematics

A SURVEY of research studies carried on during the last three years in the psychology of secondary-school mathematics disclosed that interest centers largely around the determination of errors and difficulties experienced by pupils in the subject. Usually the investigator's purpose is to develop a remedial program aiming to minimize or reduce errors. Most of these investigations are carried on in the field of algebra, although some work has been done in geometry and in arithmetic, as viewed from the standpoint of the secondary school.

The remaining studies are concerned with analyses of the nature of skills required for successful study of mathematics—determination of learning units, mathematical abilities, and evaluation of certain instructional materials.

#### Errors and Difficulties in the Study of Mathematics

Benz (489) constructed a test containing fifty items, several of which deal with arithmetic but most of which are of algebraic type. The test was given to 16,927 pupils in Ohio, and a diagnosis of 5,557 papers was made. Typical errors were recorded and explanations of difficulty were offered. The study gave numerous suggestions to teachers about ways of carrying on remedial work with their pupils and of improving instruction in algebra.

A test was designed by Christofferson (490) to measure achievement in four activities typical of demonstrative geometry: solving practical problems, solving originals, making constructions, and giving reasons for statements of a proposition. The test was administered to 6,853 pupils in Ohio. An analysis was then made of one hundred papers selected at random. The typical errors were noted and suggestions were made for improving the teaching of demonstrative geometry.

Clem and Hendershot (491) made a study of the work of eighty pupils in ninth-year algebra on seven verbal problems. They aimed to determine, classify, and analyze difficulties, and to provide suggestions for remedial teaching. On the basis of their findings they recommended that teachers employ specific techniques in teaching verbal problems. The most common causes of failure of pupils in solving problems are inability to read and to reason logically, lack of knowledge of arithmetic, and lack of proper checking.

Waples and Stone (500) devoted four chapters of their study to the learning difficulties of the pupil. They are classified as difficulties in computa-

tion, due to limitations of pupils' experiences in vocabulary, and due to pupils' personal traits.

The teachers supplied evidence as to noteworthy, desirable, and undesirable characteristics of the pupils. The most essential traits were selected to determine improved teaching methods.

Tests used in the first type of difficulty covered the major operations of the unit. The largest number of errors was found in subtraction. The process was broken up into fifty subprocesses, each of which was represented by a different type of subtraction problem. Frequency of errors was used as an index of difficulty.

Conferences with pupils were held to determine which situations were recognized as applications of the principles of the unit.

The third type of difficulty was located by varying the terminology for the problems. Twenty-nine different ways were found in textbooks for telling pupils to subtract. The relative difficulty of these ways was found.

Whitcraft (501) suggested methods for locating difficulties of pupils and described materials to be used in carrying on effective remedial work.

### **Problem Solving in Mathematics**

Dower (492) reported a study which is valuable because it gave summaries of the important investigations and experiments relating to problem solving. Of special interest are the following: situations from which real problems may be obtained; the essential characteristics of good problems; the difficulties experienced by pupils in solving problems; and the causes of failures in problem solving. Two experiments were reported which were carried on under the directions of the author. The method of giving remedial instruction following the administration and analysis of tests was discussed in detail, and measured results of the remedial work were presented.

A study made by Powell (497) aimed to gather problems most suitable for elementary algebra. From a list of thirteen hundred problems those were selected which teachers considered most genuine, most important, and most interesting.

Two hundred problems that were ranked high in genuineness and importance by the teachers were then given to the pupils, who were instructed to derive the equations and to mark the problems according to interest as "very much," "fairly well," or "not at all" liked.

Among the findings the following are worthy of mention: The problems ranked by teachers as of highest importance are those that express some kind of economic situation or material advancement. The least important are the traditional age, angle, digit, clock, and puzzle problems.

The pupils prefer problems that express activity of youth. They have little enthusiasm about activities that are expressed from the adult point of view, and about situations in which adult activity is involved. They are pleased with puzzle problems if they are presented as such.

The pupils' reactions as to interest are different from those of the adults. They do not care a great deal about genuineness or importance of problems.

Hærtter (494) illustrated a method of teaching pupils to solve problems of four different types: the uniform motion problem, mixture problem, profit and loss problem, and geometry problem. For each type the author outlined the needed fundamental facts and a list of the skills required for a successful solution, a procedure of analyzing the problem, and ways of organizing the facts.

### **Effectiveness of Teaching Methods**

Stone (499) made a survey of textbooks, magazines, and other literature to determine the methods of teaching subtraction of signed numbers. He then presented in detail six methods that he considered most effective in explaining the process so as to forestall subsequent learning difficulties.

One chapter of the study of Waples and Stone (500) is a collection of teaching methods considered effective in helping pupils overcome type difficulties in the unit on positive and negative numbers.

### **Analyses of Skills**

Everett (493) made an extensive analytical study of the written work of hundreds of pupils in algebra, and presented his conclusions. The first chapters are introductory, explaining the author's conception of the meaning of algebra, the nature of algebraic skills, and learning in algebra. The remaining chapters deal with the skills of directed numbers in the four fundamental processes, of the four fundamental operations, the function concept, the graph, and linear and quadratic equations.

Throughout the study the results showed the need for giving purpose and direction to the manipulative skills of algebra:

Although manipulation has its place in algebra, and a valuable place, it has been shown by specific illustrations that mere ability to perform algebraic operations is very small indication either that the application of a pure manipulative ability will be made at the right time or that the possibility for its use will be recognized later.

In view of the notoriously poor results attained in algebra, teachers of mathematics will find the time spent in reading Dr. Everett's study very much worthwhile.

Rebert (498) conducted an experiment to determine how formulas and familiar numerals are read when they appear in context. The study was based upon photographic records of eye movements. Sixty subjects of varying degrees of training read chemistry, algebra, physics, calculus, and geometry selections containing familiar formulas and an American history selection containing familiar dates. Forty-six high-school sophomores were used in a preliminary investigation of reading familiar dates. The study was presented under six headings: the reading of familiar dates, of familiar

chemical formulas, of familiar algebraic trinomials, of familiar physics formulas, of familiar calculus formulas, and of geometric formulas.

It was found that familiar dates tend to be read in the manner as the words in the passages in which they occur.

Difficulties were noted in the development of ability to read chemical formulas, in verbal context, and in equations.

Certain tendencies were found in reading trinomials in context among those immature in mathematics and among the mathematics experts. Formulas of a mathematical type tend to be read by experts with fixations of relatively longer duration than chemical formulas.

Physics formulas tend to be read analytically rather than as units except when the verbal context is such that the character of the formulas may be anticipated.

Calculus formulas are read analytically and in detail rather than as units.

Fixations of longer duration are used to read 3.1416 than to read the context of which it is a part. The formula  $\pi r^2$  is consistently read like the words.

When formulas are merely contributory to an understanding of their contexts, they tend to be read as words are read. When the context directs attention to relationship between component characters of the formulas, the formulas tend to be read analytically and in detail.

Pease (495) defined what he meant by a psychological learning unit and undertook to identify such units for algebra; to determine the relative difficulty of the learning units by means of a testing program; to identify typical errors of pupils who have studied the units; and to determine the amount of teaching and instructional material to be used.

For the purpose of comparison of algebraic abilities of boys and girls a complete testing program in algebra was undertaken by Pease (496). Tests were given as soon as a part of the text corresponding to the test was completed by the classes. It was found that in general the girls had the advantage over the boys in solving problems. The boys made more errors per one hundred pupils than the girls. The findings seem to indicate a slight superiority in algebraic ability in favor of the girls.

Waples and Stone (500) made a detailed analysis of the unit on positive and negative numbers to determine effective methods of learning and teaching units in mathematics. One chapter was devoted to the analysis of the unit and to the determination of desired outcomes. The last chapter suggested a procedure that may be used for a similar study of other units. The study illustrated a type of investigation which may be carried further by teachers and supervisors.

A study made by Worcester (502) aimed to determine the amount of algebra retained over certain periods of time and to relate that amount to ability and to certain types of teaching. Three forms of the *Douglas Algebra Test* were used in the investigation. The report is the first of an extended investigation to be carried on for a long period.

## CHAPTER VIII

### Foreign Languages

THE Classical Investigation (503), and the more recent Modern Foreign Language Study, which completed its work in 1928, and published its results in seventeen volumes with an eighteenth summary volume by Fife (507), the chairman of the American and Canadian Committees, gave great impetus to the investigation of problems in all phases of foreign language teaching. The failure to publish Part II of the Classical Investigation has probably made the Classical Investigation less provocative of experimentation and discussion than the Modern Foreign Language Study. In any case the past three years have seen the publication of many researches continuing the work of the study and submitting its findings and recommendations to critical analysis. The important volume by Coleman (506), embodying the recommendations of the study, was the storm center for wordy wars by Mercier and others (512, 513). The contribution of the period since 1924 (the beginning of the study) to modern language teaching is inestimable, and the benefits for educational practice will in the long run be very great.

Van Horne (519) summarized the methodological progress of the past ten years under four headings: tests and examinations, word and idiom counts, prognosis and individual differences, and the problem of objectives. Yet these had been suggested in previous contributions. Palmer (517, 518) had advocated frequency counts to determine the most valuable words; West (608) had put them to practical use in important studies; and Handschin (510) had presented the problem of individual differences and more objective examinations. The *Report of the Committee of Twelve* (514) had stated that for the two-year course the reading objective should be stressed and grammar and oral drill subordinated to this aim. Recent books on methods, notably Cole (505) and Baker (504), have treated teaching problems in the light of current research and reflect clearly the influence of the Modern Foreign Language Study.

The specific task of the present review, however, is to examine the more strictly psychological contributions of the past three years, especially factual and experimental material, and for this purpose the field has been subdivided into seven divisions: (a) tests and examinations, (b) word and idiom counts, (c) the teaching of vocabulary, (d) prognosis, (e) adaptation to individual differences, (f) psychology of learning as it applies to language acquisition, and (g) transfer and the indirect value of foreign language study. As space is limited, the general conclusions on a given topic will be given more attention than will be possible to individual studies.



## Tests and Examinations

Although objective and standardized tests have been in process of development since 1910 in other subjects, the development of tests in foreign languages has been slow. The earliest experiments in Latin were by Hanus and Henmon and in the modern foreign languages by Handschin, Henmon, and Wood. Four test batteries are now available in the modern foreign languages: the *American Council Alpha Tests*, produced by the Study (549), the *American Council Beta Tests* (574), the *Iowa Placement Examinations* in French and Spanish (568), and the *Columbia Research Bureau Tests* (575). Other standardized tests are reported for French by Broom (527), Cheydleur (531), Clarke (535), Mitchell and Puffer (559), Sammartino and Krause (569), Seibert and Wood (570), and Twigg (572); for Spanish, Alpern (521), Broom (528), Espinosa (540); for German, Van Wagenen and Paterson (573); and for Latin, Hutchinson (553), Orleans and Thompson (561), Powers (566), and Wright (577). Numerous other suggestions for the preparation and use of objective tests are given in the references in the bibliography.

One of the most important outcomes of the testing movement was the idea of a single test for all levels of achievement to secure comparability. Heretofore the difference between a high score on an elementary examination and a low score on an advanced test has been a matter of conjecture. On the all-level test it will become a measurable quantity. In the same category must be mentioned the giving of credit on a basis of achievement rather than on a basis of time spent in the classroom. The semester-hour system will soon, it is hoped, disappear, to be replaced by a plan of granting credits on a basis of level attained in linguistic ability.

The extreme conditions of malclassification existing in the modern language classes were pointed out by Wood (574), Henmon (549), Ford and Hicks (544), Cheydleur (533), Hagboldt (547), and Rockwell (567). Many students are misplaced by one semester, some by two, and a few students are three or more semesters away from their proper classification. These conditions must be remedied by placement on a basis of achievement if instruction is to be most effective. It is obvious that the improvement of teaching is extremely difficult when such a wide range of talent and achievement may be found in a single class. The effect of a placement test program at the college level was presented by Cheydleur (534).

The relative conditions in England, Canada, and the United States were presented by Henmon (549) and Ford and Hicks (544). For the first time international comparisons on a large scale were made. Norms for these countries indicate that the students in the United States are superior in all the measured abilities except in composition. This fact may be due to differences in time devoted to the foreign languages, to the age at which the language is begun, to the fact that foreign language is required or



elective, to differences in emphasis, and to the character of the tests and the schools on a basis of which norms were established.

Tests of oral-aural abilities have so far been somewhat unsatisfactory. Some progress may be noted in the investigations by Buchanan and by Rogers reported by Henmon (549), and in the subsequent studies by Clarke (535), Ferguson (543), Lundeberg (556), and Seibert and Wood (570). Adequate tests of oral-aural skills are very much needed, not only because of the emphasis upon them by some methods, but also to determine their relationships to reading ability, if reading ability is fixed as the primary objective. The contention that the best way to learn to read a foreign language is first to learn to speak the language and to understand it when spoken has many champions.

Pronunciation tests were reported for French by Greenleaf (546). Various studies on the reliability of new-type as contrasted with old-type or essay examinations in the modern language field are available. In general, the reliability of the new-type examinations is five to ten points higher than that of the essay type. Wood (574) found reliability coefficients for the old-type examination in the New York regents examination experiment of approximately .70 as against .94 for the new-type examinations in two ninety-minute tests. Ford (Henmon, 549) found higher reliability for the old-type examinations and so also did Cheydleur (532); but even so, both reported higher reliabilities for the new-type examination when the old-type examinations are constructed with the greatest care to secure reliability. Reliability coefficients reported, for example, by Wells (539) with a median reliability coefficient of .365, using grades on essay examinations from 61 teachers, were much lower. Even Cheydleur's figures, which give the essay examination under its most favorable conditions, were significant when it was considered that lowering a reliability coefficient from .90 to .80 increases the coefficient of alienation from .40 to .60. If we desire accurate measures, test reliabilities must at least reach .90, which essay examinations rarely reach and objective or new tests are planned to reach.

So far as validity coefficients are concerned, the new-type and old-type examinations appear on the whole to be about on a par.

### Frequency Counts

It seems strange that after the appearance of Thorndike's *Word Book*, which determined the relative frequency and utility of English words for reading and spelling, this method was not immediately applied to the foreign languages. The first count of this nature as a by-product of the Classical Investigation was the *Henmon French Word Book* (585). Since it is almost axiomatic that students of a foreign language should be taught first those words which occur most often and which they must, therefore, be expected to encounter and know, frequency counts of vocabulary would seem to be a first condition for curriculum improvement. The Modern

Foreign Language Study sponsored the word counts in Spanish by Buchanan (579), in German by Morgan (592), and in French by Van der Beke (595). Idiom counts are given in the volumes by Keniston (589), Hauch (584), and Cheydleur (580). These studies will probably be regarded in time as fundamental contributions of permanent value by the Study.

Word and idiom counts and their significance have been much misunderstood. The reading objective has been disagreed with and the methods proposed have been criticized. The frequency counts have in many instances apparently not been understood. The most valid criticism has probably been that of Moraud (591), who insisted that the word is not a true linguistic unit and that our teaching should be based on ideas. Until someone devises a method for counting ideas, however, this improvement over word counts is not feasible. Some of the other criticisms are more startling. It is seriously suggested that the frequency of employment of a word is no criterion either as to its fitness for a beginner's text or as a word for drill (582). Meyers (590) pointed out that many of the most frequent words are not to be found in her textbooks, apparently accepting the texts as satisfactory criteria. Others appeared to be under the impression that the order of teaching is expected to correspond exactly to the relative frequency of words tabulated, a procedure which no one has seriously proposed and which would be difficult, to say the least, to carry out in detail.

The utility of vocabulary and idiom counts lies in the preparation of minimum requirements for a two-year course (Breazeale, 578). Their chief utility lies in a course directed toward a reading objective since they are the words encountered in reading. Young (597) pointed out that many critics of the counts base their subjective estimates of word importance on conversational usage, which deviates considerably from the written language. Henmon (602) attempted to correct some of the misunderstanding and suggested a proper utilization of the results of frequency studies.

Frequency studies of syntactical phenomena, projected by the Study but not carried to completion, will be of value in indicating where grammatical training is required and where it is wasted. Frequency counts of errors in students' compositions will be of even greater value in showing what grammatical phenomena are in need of emphasis.

### **Vocabularies**

The preparation of vocabularies which should represent minimum essentials for a given work unit has been the most immediately valuable application of the frequency counts. Baker (598) presented a vocabulary of four hundred words based on Thorndike's and Henmon's lists with a few added on a basis of practical urgency. West (609, 610, 611, 612) applied word counts to the practical problem of reading a foreign language. It seems obvious that, with adult learners, the content of reading material must be above the childish level, while the form cannot be. A compromise

must be found and West found that it lies in the "translation" of classics (or at least good literature) into vocabularies of four hundred, one thousand, or any required number of words. While this may, as critics have urged but without good evidence, interfere with the literary quality of the selection, there is no question that it becomes significantly more readable. West's method provided for the introduction of new words at a known rate, then emphasis through frequent repetition when first acquired, and the final "weaning" from prepared to ordinary material. His results at Dacca seemed to indicate that the method has much promise.

We may mention one other reaction to the word counts on the problem of vocabularies. Teachers are looking with a critical eye upon the vocabularies of their textbooks, and the demand is increasing for texts constructed on the new frequency basis. This will facilitate the acquisition by the student of the necessary minimum reading vocabulary.

### Prognosis

The prediction of achievement in foreign languages is an urgent problem for several reasons. The mortality rate in foreign languages in schools and colleges is tremendously high. Again, there is a widespread belief among language teachers that there is such a thing as linguistic capacity apart from general intelligence. While modern language teachers are convinced that there is a gift for tongues apart from general intelligence, Todd (637) questioned the assumption on logical and experimental grounds. The volume on prognosis in the modern foreign languages (619), containing studies by Bohan, Brigham, Hopkins, Symonds, Todd, Van Tassel, and Henmon, reviewed the evidence on prediction from such readily available data as intelligence test scores, entrance examinations, general scholarship ratings and ratings in specific subjects, and prognosis tests. The cumulative evidence from various studies showed that the correlation between intelligence test scores and success in the modern foreign languages, whether estimated by teachers' marks or objective tests, falls most often between .30 and .40, a relationship too low for prediction. The prediction by means of school marks or entrance examinations is no more accurate. The prognosis tests of Symonds (615, 636) and Rice and Barry (615), which incorporate the best elements of earlier experimentation, held forth promise of yielding more adequate prediction. Symonds (636) gave a validity coefficient of .71. Luria and Orleans (632) reported a validity coefficient of .68. Hughes (620) reported the extraordinarily high accuracy of a battery of language tests plus intelligence in predicting Latin grades of above .90. The correlation of the tests without intelligence was .86. The evidence at present indicates that such special prognosis tests are more effective instruments than general intelligence tests or scholarship ratings. There appears under present conditions to be no escape from the trial period in foreign language classes.

## Individual Differences

Current tendencies favor the adoption of numerous measures to provide for all levels of aptitude rather than for the elimination of the unfit by prognosis tests. There is, presumably, no good reason why the modern languages should become the exclusive right of the highly or specially endowed. It may be argued that the foreign languages are such valuable instruments of instruction that no one should be excluded from their benefits. It could be contended that in fairness the inferior student, if he so desires, should be allowed to accomplish in two years, if necessary, what others may accomplish in one.

The obvious answer to the problem of individual differences is sectioning on a basis of ability. Bramlage (639) and Tharp (646, 647) reported data indicating the desirability of sectioning. Bramlage found that not only has the average achievement increased, but the average I. Q. has decreased, which means that more of the inferior students have survived for meeting this problem without separate groups.

The Dalton plan was adapted to the modern languages by Crandon (640) and Yount (649). Other suggestions for providing for individual differences were offered by Johnson (643) and Violet-Sundeen (648). An interesting suggestion is the mastery-unit plan, adopted by Kaulfers (644), which insures equal drill, equal achievement, and equal credit.

## Psychology of Learning as Relevant to Language Study

Extended reviews of experiments in this field were made by Buchanan and MacPhee (654) and more recently by Huse (662), who analyzed the most significant researches bearing upon the problem of language learning. Huse pointed out that most of the psychological studies of learning which have value for the language teacher are inconclusive. Studies on the "direct" (word-object) association method seemed to indicate that this method is superior to the translation method for children, but may not be for adults. Studies of classroom methods in general were defective in planning and performance. Psychologists so far have failed to reach satisfactory conclusions on the question of mode of presentation or the part-whole problem; but we may probably conclude that the superiority of distributed practice, of association, of the recitation method, and of organized presentation has been fairly well demonstrated.

Huse pointed out that the need for drill on a given word is determined both by its importance (frequency) and its difficulty. A word such as *action*, for example, which is identical in the languages French and English, needs no drill whatever, although it may be quite frequent and important. On the other hand, a word such as *peu*, having no connection in the two languages, needs drill in proportion to its frequency. Using nonsense words, he found that those with no connection in the two languages furnished far greater learning difficulty. On presenting words individually

(paired associates) versus presenting them in context (sentences), he found that pairs were far more effective in learning, and that associative inhibition occurred if one attempted to extract one of the words from its sentence context.

Anderson and Jordan (650) found that identical and associated Latin-English pairs were remembered much better than idiomatic phrases and other words. Teaching of derivations was suggested as an aid to vocabulary. Seibert (671) reported results similar to those of Huse, that French words are learned best in pairs, next in a mixed method, and poorest in context (sentence). This experiment was tested in artificial material by Smith and Powers (676) with corresponding results. Stoddard (682) concluded that whenever the translation is the main aim, learning should be foreign-English. When reading is the goal, English-foreign is the best method. Freeman (659) found that in testing many more correct responses are given to the unfamiliar than to the familiar stimulus.

Barlow (651) found that articulation facilitates the memorization of nonsense syllables. Bovee (652) concluded that the reading objective may not be successfully attained without a certain minimum of oral practice, and that this is especially beneficial in retention. Increased written work (653) was also effective in increasing retention. The mode of presentation depends upon age, according to Russell (670). In the fifth grade the auditory method was better, but in the ninth, visual had a slight advantage. Skaggs and his co-workers (675) confirmed the advantage assigned to the recitation method of study.

Drill is still an important factor, notwithstanding recent criticisms of the law of use. Symonds and Chase (684) found that repetition is probably the most important single factor in the acquisition of English usage by sixth-grade students. Test motivation improved performance somewhat above the level of repetition alone, but the motivation induced by description of the practical utility of English did not increase the score above mere repetition.

Sullivan (683) found that the attitude of the student is an important factor in determining the success of learning. Attitudes may be intellectual or emotional. Freeman (659) found that in complex learning mere repetition is uneconomical, while an attitude of insight contributed much to learning.

### **Transfer**

The problem of transfer looms large in discussions of objectives, content, and method in the foreign languages. Experiments were conducted for the Modern Foreign Language Study by Werner (693, 694) and Woody (695).

Werner (693, 694) reported that language study (a) increases speed and comprehension in reading, and ability in grammar; (b) is detrimental



to punctuation and sentence structure, and is of doubtful value to vocabulary and general language ability. Woody (695) found the following vocabulary gains over a one-year period: non-language students most, beginning Latin second, beginning French third. Sex, intelligence, or initial vocabulary were not important considerations.

The superior ability of language students in grammar may have been theirs before taking a language. Jack (691) found a considerable relationship between grammar scores and foreign language placement tests, especially in extreme cases. French students scored higher than Spanish students.

The value of the foreign language requirement for Ph.D. candidates was called into question by the statistics of Betts and Kent (690). Of the 2,325 doctors of philosophy reported 75 to 80 percent did not attain more than fair to poor skill during graduate study, and 40 percent admitted that their skill had decreased since graduation. The obvious conclusion is that the blanket language requirement is not justified, or else that the average Ph.D. candidate is not required to reach a level of achievement sufficient to be of real tool value.

The present review has not attempted to mention methods of instruction or the application of experimental data to classroom procedure. The recent volumes by Cole (505) and Baker (504) treated the science of modern language instruction in the light of the results of the Study, and included liberal references to psychological literature. Language study can be, and is being, founded on factual bases, which will permit a higher degree of scientific accuracy in organization and control of teaching.



## CHAPTER IX

### Science Education

SUMMARIES of objectives of science teaching<sup>1</sup> show the influence of the reports published by the Bureau of Education under the titles, *Cardinal Principles of Secondary Education* (U. S. Bureau of Education Bulletin No. 35, 1918) and *Reorganization of Science in Secondary Schools* (U. S. Bureau of Education Bulletin No. 26, 1920). Downing (726), Pruitt (772), Watkins (783), Cureton (719), and others summarized objectives for the teaching of science in the grades of the junior high school. Reports by Powers (765), by Cornog and Colbert (715), and by Gordon (732), summarized the objectives of high-school chemistry. Williams (785) gave a detailed analysis of objectives of high-school physics. Finley (728) reported a historical study of objectives of biology.

#### Content

*Science for the elementary school*—Hillman (736) found from an analysis of courses of study in science and nature study for the elementary school that there was but little agreement concerning content or grade placement, although more attention was being given to plant and animal study in the lower grades and more recognition of physical science material in the upper grades. Craig (716) developed and applied a technic for determining the principles of science that are important in the education of "laymen," and also devised a technic for evaluating principles and generalizations on the basis of their relationship to the questions asked by children. He also contributed a method of analysis of important principles and generalizations into statements that suggest the specific objectives for study in the successive grades of the elementary school.

*Science for the grades of the junior high school*—In an early study of content of texts in general science, Webb (784) reported that 98.2 percent of the materials in the texts (1919) was selected from eight special fields recognized in his classification of topics and that most space in the texts was given to physiography and physics. Klopp (751), in a more recent study, showed that authors of texts in general science agree upon the objectives to be realized but that they "fail to agree upon both type and amount of content offering for the realization of the objectives. . . ."

<sup>1</sup> Those who are interested in a full report on research in science education should consult the two volumes by Francis D. Curtis, (1) *A Digest of Investigations in the Teaching of Science*. Philadelphia: P. Blakiston's Son and Company, 1926; and (2) *Second Digest of Investigations in the Teaching of Science*. Philadelphia: P. Blakiston's Son and Company, 1931.

See also *The Teaching of Science*, Thirty-first yearbook of the National Society for the Study of Education, 1932.

Downing (725) reported the results of two analyses made under his direction and concluded "that there is no consensus of opinion as to what should be treated in a text in general science and that there is no increase in the unanimity of opinion in this matter in the late books as compared with the earlier ones." Downing (725) included in this report a summary of Heineman's (734) analysis to show the extent to which scientific principles are recognized and elucidated in general science texts. The results indicated "that principles were not uppermost in mind (of the authors) when the books were written," and that "there is little unanimity among authors as to which scientific principles are of greatest importance at the general science level in the schools."

In his digest of Downing's (725) report, Curtis (723: 75) reported the ninety-three principles of science found in twenty textbooks on general science. Cureton's (719) extensive analysis of professional articles and monographs, of eighteen general science texts published prior to 1920, and of some other types of material led him to conclude that "there is no general agreement concerning the basic aims of junior high-school science."

Curtis (721) reported a statistical evaluation of 1,850 topics in general science on the basis of the recognition which the topics have received in various sources including textbooks, syllabi, interest studies and analyses of science in newspapers and magazines. A "final relative value" was assigned to each of 1,850 topics.

*Biology*—Richards (775) studied course content in high-school biology in different parts of the United States in 1923. He found a great variation in practices in the teaching of biology. His data showed types of courses offered, texts used, and time allotment for instruction. Richards (776) analyzed textbooks to find what topics in biology receive most recognition. He reported a list of thirty-five topics arranged in order of importance. Hunter (740) found that schools in Illinois showed fair agreement in choice of content. He submitted 98 topics to 115 schools and found that 84 of the 98 topics were recognized in 90 percent of the schools. Finley (728) found increased recognition of general biology and a decrease (shown by statistics on enrollment) in the recognition given to the special subjects of botany, zoology, and human physiology. Ruch and Cossman (777) determined the content of courses in biology by means of a statistical analysis of final examinations obtained from leading high schools. Some three hundred topics were obtained and these were subsequently evaluated by teachers and "authorities" on the teaching of science. Presson (770) determined the relative importance of subjectmatter topics in biology on the basis of an analysis of (a) textbooks, (b) teachers' final examinations, (c) College Entrance Examination Board questions, (d) questions of the Board of Regents for the State of New York, (e) courses of study of state departments of education, and (f) courses of study of public secondary schools. Hill (735) found that pupils who are taught the content of a state

(Kansas) course of study for general science "are prepared to read easily about 89 percent of the biology found in general purpose magazines." Merrill (760) compared the recognition of the same topics in botany texts and in articles in periodical literature. He found relatively more emphasis in the periodicals upon food-producing plants and upon economic phases of plant life, and relatively less emphasis in the periodicals upon lower forms of plant life. The analysis of *Biology in the Public Press* by Finley and Caldwell (729) showed that health receives largest recognition in newspaper articles. Other topics listed by these investigators in the order of recognition are animals, plants, foods, organization of producers, nature evolution, and fictitious biology. Meier (759) and Chappellear (712) each reported analyses to show the recognition, in terms of percentage of space given to health education in textbooks and courses of study in science. They found that texts in biology give largest recognition and that texts in physics give least. Baird (700) studied notebook practices in the teaching of biology in New York State and reported in detail on the types of work that is done.

*Physics*—Glenn and Brookmeyer (731) reported an analysis showing frequency of recurrence of topics in physics in the "Old Plan" questions and in the "Comprehensive Plan" questions of the College Entrance Examination Board. Kiebler and Curtis (748) ascertained the frequency of appearance of laboratory exercises in physics in widely used laboratory manuals and they determined the relative importance of the exercises as indicated by judgment of experts. They found 175 exercises in eight manuals. None of the exercises were considered essential to the course by all the evaluators, and only four appeared in all of the eight manuals. Downing (726) determined the relative importance of principles in physics on the basis of frequency of recognition in farm and trade journals and on the basis of a "job-analysis" of the activities of the housewife. His list of "principles" is given, each with index numbers to show the order of importance in the different sources. Kilzer (750) solved the problems in three texts in physics and listed the mathematical processes involved. He reported that high-school physics involves a considerable body of information about mathematics; that it is not very difficult; and that the information is usually taught in courses in arithmetic, algebra, and plane geometry.

*Chemistry*—Gerry (730) reported the frequency of most common types of questions and topics in the College Entrance Examination Board questions in chemistry. Certain topics, including equations involving nitric acid, the Electrolytic Dissociation Theory, and the laws of Boyle and of Charles, had frequent occurrence. Brown (709) found that there is a very definite agreement among authors in the selection of subjectmatter for laboratory manuals in chemistry. Sites (780) determined the chemical principles, concepts, and technical terms used in science magazines and which are proba-

bly needed to enable the individual to read such magazines intelligently. The analysis included all issues in a period of four and a half years of *Popular Science Monthly*, *Scientific American*, and *Scientific Monthly*. The principles are rated on the basis of word space and on the basis of frequency. Nuser's (763) analysis of articles in *Farm Journal* and *American Farming* showed the chemical terms which appeared with most frequency. Boles and Webb (707) and Rendahl (774) reported analyses to show the kind and amount of mathematics needed to solve problems in chemistry.

*Other studies to determine content*—Harap (733: 324-30) reported objectives for a course in science appropriate for the education of the consumer. Hopkins (737) found from his examination of newspapers and magazines that biological science received much greater recognition than any other division, receiving on the average about four times as much recognition as physics. Physics was second in order of recognition and astronomy was fifth. Searles and Ruch (778) reported findings similar to those of Hopkins (737). The investigation by Curtis (722) of the scientific knowledge required for an intelligent reading of the public press showed a great diversity of scientific topics. The analyses of children's questions by Pollock (764), of children's and adults' questions by Curtis (722: 27-40), and of children's and adults' questions by Craig (716) showed great diversities in scientific interests. Meier (758) reported a comparison of practices in the planning and teaching of science courses in German and American schools. Kilander (749) reported a similar comparison of practices in Scandinavian and American schools. A study by Kok (753) compared practices in science teaching in America, England, and the South African states.

### Vocabulary Studies

Vocabulary studies showed that texts in science carry many uncommon and technical terms. Powers (767) found that texts in biology carried over two thousand words that were not found in Thorndike's *Teacher's Word Book*. Texts in physics and in chemistry contain about sixteen hundred such words and texts in general science contain about thirteen hundred. A large percentage of the words appeared with but a single frequency. From all the sources examined Powers (768) compiled a list of 7,948 "uncommon" terms in the sense that they were not found in Thorndike's *Word Book*. Using an objective technic he selected and published a list of 1,828 terms which, by the criterion of frequency, were called important. Curtis (720) studied the vocabulary used in scientific articles appearing in the daily press. He found that there were relatively few words in these articles that were not in the *Word Book* but that a relatively large percentage of the "uncommon" words were scientific terms. Pressy (771) published lists of technical terms used in science textbooks.

## Sequence and Overlapping in Science Courses

Hunter (741) showed that the established courses in grades nine to twelve are general science, biology, physics, and chemistry. These showed increases in enrollment between 1908 and 1923 and other science courses generally showed decreases. Leker (756) found that texts in general science overlap succeeding courses and that pupils who take general science will have had 41.4 percent of the physics course, 34.5 percent of the biology course, and 25 percent of the chemistry course. Cramer (717) and Carpenter (710) found that the study of general science contributes measurably to success in subsequent science courses. Koos (754) reported a detailed analysis of texts and laboratory manuals in high-school and college chemistry. He found that practically all of the high-school course is included in the introductory college course.

## Measurement of Results

Dvorak (727) found that pupils are already familiar with much of the material in general science texts before they take the courses and that achievement is uniformly higher by pupils who have had a course in general science. Ashbaugh (698) gave the *Powers General Science Test* and the *Ruch-Popenoe General Science Test*, a total of 215 items, to pupils at the beginning of the ninth grade, who had studied general science in the eighth grade. The same tests were given at the same grade level to pupils who had not studied general science. He found that the general science group did significantly better on but 14 percent of the 215 items.

Ruch and Cossman (777) and Presson (770) reported results from measurement in biology.

Hughes (739) found that pupils in classes in physics with teachers who have carried a college major in this subject do better than those in classes with teachers of less training. He also found that pupils with higher intelligence scores do measurably better and that there are consistent differences in attainment scores of pupils in large and in small schools.

Powers (769) selected 350 test items from texts in common use in the teaching of chemistry and gave these as a series of tests to pupils in chemistry at the end of a year's study. A second application of these tests was in "delayed testing" in which the tests were given to individuals with intervals up to five years following the period of instruction. The results showed that there is a wide range of difference in achievements in different high schools; that comparatively few students gain facility in writing the formulas and equations and solving the mathematical problems in the textbooks; that such facility as is attained in writing formulas and equations, solving problems, and doing other tasks of the tests, is rapidly lost after instruction has ceased; that the differences in achievement between high-school pupils and university students is not large and the difficulties shown



to exist for high-school pupils exist for university students. Gerry (730) reported upon the questions associated with causes of difficulty. Bennett (704) analyzed the errors made by pupils in response to test items and found that in writing equations errors are made in the writing of simple formulas; he also found that pupils who made errors did not make consistent errors when the same response was asked for in different parts of the test. In a later report Bennett (703) showed that attention by the teacher to the causes of difficulty results in increased attainment.

### **Learning Studies**

Black (706) took an inventory of the concepts held by pupils before and after instruction, concerning certain physical concepts and classified these as naive and as scientific. A scientific concept was defined as one that denotes a true relation. With the inventory in hand he launched upon a teaching experiment in which he studied the difficulties attendant upon the development of scientific concepts. His results showed certain positive results from the study of general science and other positive results from the study of physics. He concluded that the "concepts of acceleration, specific heat, dew and rainbow formation, light and mass, do not generally become scientific through the study of physics."

MacKay (757) studied the relative effectiveness of teacher planning and pupil planning in a program of experimental teaching directed toward enlargement of understanding of a scientific generalization.

Laton (755) reported after teaching "an experimental and a control class" that "application of the facts and principles which experimental work in the psychology of learning has established can be profitably made to the teaching of such complex subjectmatter as that of biological science directed toward health education on the secondary-school level." Douglass (724) found the recitation-study sequence "probably more effective" in general science than the study-recitation sequence. Shriner (779) has reported favorable results in general science from his plan of "residual teaching." Corbally (714) found that neither the "assignment-recitation" nor the "unit" plan is distinctly superior but that the determining factor of success is the teacher. Beauchamp (701) found his method of directed study relatively more effective than a method of semi-directed study. Watkins (783) reported that "pupils engaged in project work do as well in reaching commonly accepted aims of general science as measured by the general science test used in this study as pupils engaged in the traditional text-recitation-laboratory work." Beauchamp (702) found that the relative progress of pupils in general science is not constant, and that there are no significant correlations between the measures of intelligence that he used and the rate of progress. Wood and Freeman (786) made an extensive study of the use of motion pictures in science teaching.

Hurd (742), working in physics, found definite advantage in teaching information favoring his "topical method" over his "problem method." In another study Hurd (744) found that previous marks in mathematics are a most reliable indication of success in physics, and that the "I. Q. will serve as a good index of success in physics." In a third study Hurd (745) reported somewhat superior achievement in physics from the use of a workbook. Williams (785) used a directed study plan in the schools of Los Angeles with positive and significant results.

Working in chemistry classes, Bagby (699) found that students of median and low intelligence profit more from study in which class discussion precedes laboratory work. Stubbs (781) found a slight advantage in favor of full laboratory notes over the method of filling blanks. Powers (766) reported that marks of attainment in chemistry for students of poor to median ability correlate more closely with intelligence than do marks for students of superior ability. Bray (708) reported a positive relation between reading ability and success.

### **Experiments in Laboratory Teaching**

Kiebler and Woody (747), Coopridner (713), and Knox (752) published results from experiments in laboratory teaching that seem to favor the demonstration method over the individual method of laboratory instruction. Others, including Cunningham (718), Walter (782), Carpenter (711), Pruitt (773), and Anibel (697), published data showing no difference in results from the two methods or favoring slightly the individual method. In each of the foregoing studies results were measured with tests of information.

Horton (738) found no significant differences in attainment on subject-matter tests among pupils with which a variety of laboratory methods were used. He found, when the tests were constructed to measure abilities that were definitely exercised in the laboratory, that there were statistically significant differences between different experimental groups. Horton studied methods for developing ability in laboratory technics, in generalizing, and in problem solving.

### **Experiments on the College Level**

Johnson (746) found that courses in agriculture in college drew heavily upon the field of botany, but that students who had studied botany did no better in agricultural courses than those who had not. He found, too, that the loss in retention of botanical knowledge was at a rapid rate. He studied the effects on success in botany of (a) taking the course as a requirement, (b) previous preparation in high-school science, (c) interest, (d) sex, and (e) intelligence. He found that within the experimental classes these factors had but little bearing on success.

Noll (762), working with college classes in chemistry, varied the amount of laboratory instruction and introduced some other procedures as substitutes for laboratory work. His measures showed no statistically reliable differences between his experimental groups.

Hurd (743), from his study of classes in human anatomy, found no advantage in assigning two students to one cadaver over assigning four students to one cadaver. He also found "some evidence" that seven and a half hours of laboratory work in anatomy produced measurable achievement in excess of that produced by five hours of laboratory work plus two and a half hours of library work. In another unit of this study, Hurd found little or no advantage to students in architecture favoring laboratory and lecture work over a lecture course in mechanics. From another unit of his study he reported "no definite proof that . . . class size is a significant factor in achievement in elementary physics . . ." (on the college level). His data showed that students who have had high-school physics do significantly better in mechanics on the college level than those who have not studied high-school physics. In these studies Hurd recognized the inadequacies of existing measures of "educational products."

In the field of teacher training, Billig (705) has developed and applied technics for the selection and organization of core and marginal content for a professional course in science for students preparing to teach in elementary schools.

## CHAPTER X

### Commercial Subjects

**D**URING the past two decades commercial education in the secondary schools has grown to an enormous extent. It is estimated by Davis (804) that about 45 percent of the secondary students in the North Central Association of Secondary Schools and Colleges are taking one or more commercial subjects. With increased enrollments have come accretions of problems concerning courses, curriculums, equipment, and the like as well as problems of the psychology of learning. These have been investigated extensively by numerous persons, and more than eight hundred studies have been made, from which the following have been selected for this report.

Space allotments forbid anything like complete reports of the forty-odd studies concerned with the psychology of commercial subjects. Complete references are appended, however, so that anyone interested in individual studies may secure them for more elaborate perusal.

#### Choice and Organization of Materials

Beatty (791) analyzed magazines and guides to periodicals to determine the economic topics most frequently mentioned, and gave detailed findings under the groupings of production, exchange, economic conditions, public finance, consumption, and distribution. His results should be of value to teachers of economics. Ames (787) secured from fifty schools detailed statements of items or topics of retail selling which they were teaching in their courses in salesmanship. Burns (795) analyzed the business transactions reported in the personal activities of 1,598 adults in a large city to determine which ones are of major importance for instructional purposes. At Colorado State Teachers College, Dick (805), Ross (825), Sublette (828), and Frutchey (808) secured from various groups of laymen, business men, and governmental agencies statements of items of business which everyone should know. Their methods were similar and their materials, combined with those of Milley (820), who made a similar study from magazines, are valuable aids in determining a common body of business information. Kinney (815) made an elaborate analysis of the arithmetical duties of office workers, for the use of teachers of commercial arithmetic and for authors of textbooks in that subject. Kyker (816) made a job analysis of the duties of stenographers, and Charters and Whitley (799) made one for secretaries. Both studies pointed out the many essential abilities of such workers in addition to their shorthand and typewriting. McCarty (819) analyzed the technical errors made by high-school students in English, for the purpose of determining the items upon which additional

emphasis should be placed. Nichols (822), under the auspices of an association of office managers, studied the duties of thousands of general office workers, to determine the essential content for courses for clerical workers. Strumpf (827) and Nyquist (824) each analyzed the duties of bookkeepers and both showed that in addition to bookkeeping, clerical duties are frequently met. Hatch (812) compared units commonly taught in high-school salesmanship with practices found in stores, and discovered that much was lacking in the school courses. Tonne (829) found little in the home lives or employment possibilities of ninth graders to justify the study of bookkeeping in that grade.

### **Experimental Study of Methods of Teaching**

Atkinson (788), in a limited study, suggested that in teaching bookkeeping, the balance sheet approach, which attempts to provide a background of reason for bookkeeping procedures, is more effective than the journal or ledger approaches, wherein procedures are apt to be based upon rules.

Keck (814) showed that present-day methods of instruction in commercial arithmetic for one semester, result in very little increase in efficiency.

In the field of shorthand, Brewington (794) presented the subject as a language art, with emphasis on thought content in reading shorthand outlines; Barnhart (789) suggested a direct-association method, involving the development of rapid reading, and automatic shorthand writing; and Munkhoff reported success in a direct-writing approach with emphasis upon transcription and abandonment of emphasis on rules and shorthand penmanship. On the other hand, Bisbee (793) reported greater success with development of principles and the use of dictation than with a reading approach. Hayes (813) reported an error analysis of the work of shorthand students to determine the units requiring more attention, and Walsh (830) determined the frequency of occurrence of diphthongs to supplement word frequency studies. Primary emphasis seems to be going to methods of teaching shorthand which shall agree with modern psychological principles and to procedures for developing better transcription ability. A number of studies on this last problem are now under way, but the results are not yet available.

In typewriting, studies by Barton (790), Gamwell (809), Fleming (807), Lomax (818), and Hainfeld (811) seemed to reveal that instead of approaching this subject by isolated letters in nonsense order, the use of sensible content material (the whole method), from the beginning, gives better results. Lahy (817), and Entwisle (806) reported that the practice of emphasizing rhythm drills is of doubtful value in spite of the fact that it has been widely used. Butsch (796) indicated that the learning curve for advanced (second year) students approximates that for beginners, although the increase in efficiency is only about 60 percent over the first year's attain-



ment. Coover (801) studied procedures for learning finger movements by kinæsthesia or feeling-memory, and reported better success than by the older method of attempting to recall, consciously, the various movements necessary in typing. North (823) showed that students in the upper grades of the high school learn typing more readily than do students of the ninth and tenth grades. Rowland (826), however, told of success in teaching typing to elementary-school pupils. Coffman (800) and Young (832) reported that single periods are sufficient for typing and showed that double periods are of very little greater value than are single periods. Green (810) indicated that the recent tendency of providing much practice on the commonest words in early drill is, in effect, "gilding the lily" because in ordinary cursive writing students probably get enough practice on them. If this is true, it will necessitate great changes in typing textbooks which have almost unanimously adopted the procedure of basing drills on common words. Wakefield (831) has a very significant study on trait development through typing. She provided a series of direct exercises of increasing difficulty, each of which called for resourcefulness, and mentioned high achievements in development of that trait thereby. If her study is dependable, it will open new paths for trait development in other subjects as well. Coutts (802) showed that the somewhat common practice of requiring a teacher of typing to conduct a class in some other subject, while a typing class works in the next room, and of expecting her to supervise the typing work through glass partitions, is ineffective.

### **Studies of Interests**

Cavan (798) made an elaborate study of the interests of business girls, which is valuable for church, club, or class programs and for guidance purposes. Craig (803) studied the interests of retail saleswomen to see if they correlated with selling success, but found contradictory data.

### **Problem Solving**

Beers (792) studied eleven situations in problem solving in commercial arithmetic and reported that short drill periods are best, that the teaching of new processes and short cuts are followed for a time by losses in efficiency, and that the habit of accuracy is essential. Butsch (796, 797), with a timing device attached to a typewriter, found the average times required for different kinds of strokes, and by means of a camera measured the eye-hand span in typing, showing that it is shorter than has been supposed.

Many of the studies reported are of limited scope and possibly not one is fully conclusive. Nevertheless, each contributes somewhat to more accurate knowledge and is, therefore, well worthwhile. Every effort should be made to foster and to encourage further investigation in the psychology of commercial subjects.

## CHAPTER XI

### Industrial Arts

**I**NDUSTRIAL arts is a recent arrival in the subjectmatter family in education. Being a youngster, it has been so busy establishing a lease on life that it has had no chance to pause and search for facts to prove the worth of its existence. Consequently, only a little more than the obvious is known about it. The older members of the family, who only recently have realized the possibilities and values of research in their regimen of present and future academic health, are still too busy with their own troubles to give the neophyte needed and timely tuition.

Teachers, recruited in the past chiefly from the industries, emphasized the only thing they knew—skill in narrow specialized tool processes in the construction of accurate products with the unwarranted hope of beneficial character transfers. Including the industrial arts in its rightful place as one of *the arts* it is seen that Speer's findings apply when he said, "Certain it is that a thorough course in the production of art products cannot be safely depended upon to develop art judgment or appreciation" (851). Even in the narrower fields of manual dexterity and visual discrimination, Langdon and Yates (840) found no evidence of transfer.

Strickler (852) found that teachers are receiving progressively better professional training, decade by decade, which is a hopeful sign, since an analysis of this training showed that teachers believe in the kind of training they themselves received to the point of recommending it for others. Warner (853) reported an effort for orientation of policies with a special consideration of objectives.

The most significant foundational research in the industrial arts field has been in the preparation of instructional material which is now coming from the publishers. It is exceptionally specific and well-illustrated and augurs the appearance later of instructional material of the self help type, which will be most effective in individual personal learning. McGee and Brown (842), in their book on wood finishing, illustrate the kind of offerings of many divisions of the arts which are easily found superior upon comparison with the texts of five to ten years ago.

The industrial arts section of the American Vocational Association has had a Committee on Standards (833) working for three years upon a tentative list of fundamental teaching units. This committee, composed of seven recognized leaders from different parts of the country, is continuing to direct a study which enlists the cooperation of teachers and supervisors. The emphasis of this study is directed upon (a) what the pupil should be able to do; (b) what the pupil should know; and (c) what the pupil should

be at different grade levels. Schell (849) reported a study of courses and equipment for general metal shops in fifty-one schools. The division of research of the Denver schools conducted an analysis of home mechanics jobs in the community as a basis for more intelligent local instruction in the subject (835). Newkirk (843) has "validated" a home mechanics test which "can be used in instruction, diagnosis, and measurement."

An experimental study by Gunther (837) showed that manipulative participation experiences provide a natural setting for learning with a resultant retention of a greater number of facts than may be obtained through book study alone.

The shop may be used in motivating academic class work and keeping pupils in school (848). Mackaye (841) studied the vocational interests of four hundred children and reached the conclusion that early fixation is correlated with low intelligence and that deferred fixation characterizes normal, good, and intellectually curious people depending upon the age of this manifestation. Fryer (836) found that "interest expressions are of no significant value as criteria of abilities. They are suggestive only." Henig (838) concluded that "neither mechanical aptitude nor general intelligence appears to play any great part in the success of the vocational school apprentice in his trade practice." He found also (839) that there are factors other than intelligence involved in shop accidents.

Bawden (834) summarized the findings of value for the industrial arts teacher of current beliefs in regard to individual differences. Proffitt (846) compared the performances of experienced and inexperienced persons in cross-cutting a board. Reed (847) experimented with the development of skill in using the "yo-yo" top and concluded that training reduces inequalities in the accomplishment of individuals. The teacher's measure of individual accomplishment in the construction of projects is highly unreliable as is shown by the variability found in the results of a study by Newkirk (844).

Paterson, Elliott, *et al.*, (845) recently completed a study to determine the possibility of developing means and methods for "discovering and measuring mechanical ability." Many attempts at measurement are being tried in the industrial arts field, though it must be confessed that most of them are confined to subjectmatter and performance only. Smith (850) listed forty-two authors of such tests, with titles and publishers, and over a hundred periodical references. It is hoped that something more fundamental than either knowledges or skills will receive competent imaginative attention in the near future.

The development of the industrial arts and a realization of their worth to education are dependent upon the training of many industrial arts teachers to do research and the further provision of opportunities for the utilization of this training.

## CHAPTER XII

### Fine Arts

IN THIS section of the monograph only the most recent and most outstanding researches in the field of art education are reviewed. The investigations in this field at best are only fragmentary. The technics used are often crude and the findings of many of the investigations are incomplete. However, enough has been done to show that workers are interested in the scientific aspects of curriculum and learning problems.

#### Measurements in Fine Arts

The early studies were largely subjective and were concerned with children's reactions to pictures. Thorndike (877) pioneered in the effort to measure the child's achievement in drawing. While the *Thorndike Drawing Scale* was somewhat crude, it was influential in showing the need for more objective studies. Tests which measure art appreciation and aid in predicting achievement in art are difficult of construction.

The problem of measurement was approached by Ayer (855) and Manuel (868) through general testing. Ayer employed general testing to discover the relationship between drawing ability and other abilities. In this study, ability in drawing was found to correlate to a negligible degree with ability in other school subjects.

Manuel (868), after administering a large number of tests to persons talented in drawing, came to the conclusion that traits significant for art talent can be discovered through general testing.

Kline and Carey (865) undertook to construct a scale which would measure the drawing achievement of pupils in the elementary grades. A number of sample drawings, 5,214, were collected under controlled conditions on four subjects: house, rabbit, tree, and figure in action. In the original edition the samples were scaled by ninety-two judges, and the steps between the samples were determined by methods previously used by Thorndike and others. There are a number of later editions of this scale.

Christensen and Karwoski (857) tried several methods in measuring art talent and achievement. In the first a comparison was made between two examples of art and one of five reasons selected as the one which indicated the superiority of the selected example. The second method consisted in selecting one of four examples.

Lewerenz (867) desired to construct a test which would evaluate certain abilities that condition success in art and then to study sex differences. He selected the following abilities: recognition of proportion, originality of

line drawing, observation of light and shade, knowledge of vocabulary of subjectmatter, visual memory of proportion, analysis of problems in perspective, and recognition of color. He concluded, with regard to sex differences as follows: Girls are superior in originality of line drawing and in color recognition, girls manifest more conservatism in general, boys vary more in ability than do girls, girls have a greater sense of rhythm and color.

Meier (873) in his *A Measure of Art Talent* used the technic of controlled alteration process. After considerable experimentation with a ten-variation presentation, a two-variation presentation was adopted. In constructing the scale some significant element in the composition was changed so as to affect the balance, unity, or other principles. The altered composition in practice is to be compared with the original.

McAdory (869) developed a multiple-choice test consisting of seventy-two items, each of which contain four pictures of the same type. The test involves three art elements, color, line, and light and shade. The test gives a high coefficient of reliability when two parts of the test are correlated: .869 for thirty-six test items, and .93 for seventy-two test items. Grade norms have not yet been established.

### Children's Interests

There are a number of studies which bear somewhat on children's interests. Feasey (859), in a study involving plain and colored rectangles and various geometrical forms, found no evidence for an emotional basis of esthetic judgment. Dorcus (858) found that saturation and brightness are not so important in determining color preference as is hue.

Garth (860) had one thousand children arrange in order of preference seven color discs of white, yellow, orange, violet, green, red, and blue. He found that color preference in children running from most to least preferred is blue, green, red, violet, orange, yellow, and white. As a rule the boys were more decided in their preferences.

The most extensive study of children's interests was made by McCarty (870). Her purpose was to construct a series of scales based on the interests of children in the primary grades. She found that children are more interested in drawing the human figure than any other form. Houses, trees, furniture, and vehicles come next in order.

Michaels (874) studied color preference in 535 boys between the ages of six and fifteen. His findings are practically the same as Garth's. No significant difference can be attributed to the age factor. Some evidence was found that environmental and social status influence color preferences.

Williams (879) investigated children's preferences for pictures. Classes of fifth-, sixth-, seventh-, and eighth-grade children were taken to an exhibit of 134 pictures. Later 1,092 children visited an exhibition of 100 additional paintings. Studies were made of the children's interests. It was found that



children prefer pictures in which there are a few large, easily distinguished objects in the foreground.

Arlitt and Buckner (854) studied the color preferences in twenty-five negro and twenty-four white children between the ages of three and four. Negro children had more decided preferences but no significant racial color preferences were found. Both races avoided the color green, and agreed in preferring red and blue.

### **Miscellaneous Studies**

Goodenough (861) sought to determine the extent to which the nature of drawings made by children in their early years is conditioned by intellectual development. A drawing scale for measuring intelligence was constructed. This scale gave a correlation of .763 with the Stanford-Binet mental age.

Brooks (856) studied the influence of the use of drawing scales on accuracy of ratings. He found that the use of a scale decreased the inaccuracy of ratings to about one half of what it is when no scale is used.

## CHAPTER XIII

### Music

THE experimental work in the field of music education consisted roughly of two types: criticism and refinement of existing tests with a few attempts to measure music performance, and the rapidly growing work of music over the radio.

#### Criticism of Tests

Nielsen (914) showed that capacity tested in motor rhythm correlates highly with musical ability and performance. Williams (925) confirmed the fact of varying reliability of the *Seashore Tests* and very low inter-correlation. Gaw (893) modified them for the fifth grade, securing higher intercorrelations; also higher scores with the Panotrope than with the Columbia phonograph. Brown (883) showed negligible correlation between them and instructors' rating of musical capacity. McCarthy (908), working with five tests, showed high reliability for memory and pitch on retest, low validity for intensity. She concluded the tests are of greater value to predict failure musically than success. Stanton and Koerth (919) found negligible change in score after three years of intensive training of adults, claiming they are valid tests of native capacity. Moos (912), criticising the *Schoen* and *Kwalwasser Tests* as well as the *Seashore*, warned that tests of sensory capacity only are not an index of the total musical talent. Brennan (882), using motor tests as well, found that students with superior capacity tend to rank higher in performance as rated by judges.

The use of tests was reported by Larson (905) in connection with the selection of junior high-school pupils for instrumental classes, showing that the scores correlate with the selective factor for membership in the orchestra. Burns (885) emphasised caution in rejecting those who score low in a pretest. Highsmith (897), correlating teacher ratings on performance, was doubtful of the value of prognosis on the basis of sensory capacity alone. Tilson (921), working with state teachers college students, showed higher scores from those in the music department than from those in the ordinary courses, and found prognostic value for achievement and teaching of music. Kwalwasser (902) found the intelligence scores of music students below the average of freshmen in general. Mursell (913), in sixty-one returns to a questionnaire, found a favorable attitude towards music tests in high schools, with development of local tests both for assessing instruction and for diagnosis and selection for instrumental classes. Dykema (887) demonstrated their use to evaluate instruction and planning for a music course in a school system.

McGinnis (910) reported that with suitable modification in explanation, the *Seashore Tests* of pitch, intensity, and consonance can be used individually with children of nursery school age. Children over 135 I. Q. do not prove superior to average children of their age in musical sensitivity, according to Hollingworth (898). White children scored better than colored in pitch, intensity, time, and memory, and less well in consonance, in a study by Gray and Bingham (894). Fracker and Howard (892) found no correlation between intelligence scores of college students and scores on five *Seashore Tests*, a slight correlation with the pitch test.

### New Tests

The Kwalwasser-Dykema battery of ten tests, available on Victor records (903), is the best rival to the *Seashore* series. The authors are undertaking extensive work with them, the results are as yet unpublished. Salisbury and Smith (916) and Wright (926) described information and achievement tests used with normal-school students. Tests of music appreciation, not yet standardized, were reported by Hevner (896), Lowery (906), and Vernon (923).

New or improved instruments for testing procedures have been devised. The reproducing piano with the duo art roll is urged as a good instrument for standardizing test procedures by Whipple (924) and Farnsworth (891). A test for appreciation was constructed by Adler (881) on the pattern of Schoen's earlier tests and the Abbott and Trabue work in English literature. Metfessel (911) described a strobophotograph camera, since improved by Tiffin and Reger, for use in vocal performance. Tiffin and Seashore (920) introduced a piano camera which records the duration, intensity, pedal action, and hammer velocity during normal pianoforte playing. Jacobson (900) gave a preliminary report on photographing eye movements during music reading, and concluded that new reading material should be prepared for school use.

### Other Experiments

Brown (884), from a slight experiment, showed that the whole method is superior to the part in "learning" brief piano selections. Cheyette's work of introducing orchestral work for fifth- and sixth-grade pupils is yet unpublished except in a book of music appropriate for the children. Coleman (886) demonstrated possibilities of symphony playing and composing by fifth and sixth grades. Kinscella (901), Schwin (917), and Smith (918) reported on the feasibility of class instruction in piano playing for children and for adults, with progress in achievement acceptable for entrance requirements at a school of music.

## Music Education by Radio

McConathy (909) gave radio piano instruction to beginners, with charts to be procured from the National Broadcasting Company. Howard (899) described McConathy's work and contrasted it with Spæth's. Maddy (907) reported group instruction for beginners on band instruments successful to the point of admitting students to the high-school orchestra.

The Wisconsin experiments were described by Ewbank (889, 890) and Perry (915). Children of the sixth, seventh, and eighth grades in twenty-five experimental rural schools, checked by an equal number of control schools, listened to well-rehearsed broadcasts which gave musical information, selections for appreciation, rhythmic exercises for immediate participation, and instruction in class singing. The *Gildersleeve Tests* for information given before and after the series of lessons showed an improvement with a critical ratio well above four in favor of radio-instructed children. Results were otherwise checked by the making of scrapbooks and by visitation to see the children at work and hear their songs.

The Damrosch programs, judging from the sale of the work books to accompany them, reached a very large number of school audiences. La Prade (904), Dykema (888), and Harrison (895) reported on these favorably. Harrison tested fifteen hundred rural children before and after the Damrosch experience and found a growth in information, especially above the sixth grade. Third-grade children did not profit measurably by the information items which Damrosch includes. Measures of appreciation are not yet developed for testing this type of work.

## CHAPTER XIV

### Health

ONE of the outstanding recent developments in education is the new emphasis on physical health. Many educators, as yet unconvinced, prefer to carry on until more satisfied of the educational content and value of physical education. There is here a deeply rooted implication that health is not in itself of prime value, but that it must establish its influence on intellectual attainments by which the success or failure of education is still measured.

The general acceptance of biological evolution as explaining the present human physique has emphasized the significance of physical activity. Since the adult human is by weight 40 percent to 45 percent muscle and a very large proportion of the nerve musculature is skeletal and related to motor performances, the conclusion drawn is that man as a species has attained these proportions as a result of vigorous physical activity in his phylogenetic experience. There has developed then an association between physical activity and health.

Mere physical activity is by no means the whole story. Young (1975:92-5) emphasized the need of keeping in mind as objectives in physical education, health, physical efficiency, and emotional control.

Williams and Hughes (1974:74) submitted the following as aims of physical education interpreted for athletics:

Physical education should aim to provide skilled leadership and adequate facilities that will afford an opportunity for the individual or group to act in situations that are physically wholesome, mentally stimulating and satisfying, and socially sound.

### Physique and Intellect

Those who accept the wider aim of education as "preparation for life" are agreed in their appreciation of the value of a healthy physique as the biological basis for other attainments. Beyond this rather general idea there is a good deal of question as to the nature and extent to which intellect may be conditioned by physique. Kiefer (1958) found that differences in manual motor tests of superior and average children are negligible.

Alden and Top (1928) reported a failure to establish any correlation between certain measures and intelligence. Hertzberg (1952) concluded that motor development by itself does not correlate significantly with the mental age in the kindergarten stage.

Paterson (1965) was the most outstanding in his conclusions that there is no positive relation between physique and intellect. He took the position that nearly all of the investigators along this line fail to comply with scien-



tific requirements of research procedure, and in consequence their conclusions must be thrown into the discard.

Some investigators have held strongly that fundamental development as represented by physiological age rather than mere structure or mass should be the basis for rating the physical and mental. In fact it has been proposed that some measure of this physical or physiological development be substituted for chronological age in the I. Q. formula.

On the other side of the question Cook (935) showed that even anatomical development has a relation to some educational problems. Simkins (971) insisted on an essential structural basis for intelligent responses. Quirk (968) worked a relationship through quotients.

Nelson (964) found quite a definite relationship between well-nourished and developed pupils in the elementary grades and the achievements of which they are capable. Wheeler (973) reported small and fairly consistent differences in the majority of measures studied between dull and normal Italian children, and further urged that these differences should be considered as a factor in the classification, instruction, and promotion of children who deviate widely from the normal physical growth. Hollingworth (954:356-7) reached the conclusion that:

Measurements of stature, repeated annually on a group of growing children, starting at a mean age of 108.1 months and continuing from 1923 to 1929, inclusive, show that intellectually gifted children run constantly about 5 percent taller, as a group, than do unselected children. . . . As a group, intellectually gifted children consistently maintain their tallness as they grow toward maturity. At the mean age of fifteen years, no trend in the direction of mediocrity has appeared.

Caldwell, Skinner, and Tietz (933) considered it worthwhile to devote an entire volume to setting forth the details of physical growth and development. They treated biology so as to include man as the thinking animal with his behavior and culture. Their hope was that by this contribution there may come a more purposeful development in the philosophy of education, which at present is undergoing adjustment as to both its purposer and processes.

### **The Learning Process**

From the purely mechanical side, Affleck (927) attempted to show that three essential aspects of motor activity, involved in learning, are direction, strength, and timing. In the learning of a new movement or series of movements there arises the question of whether learning may be more rapid by analysing into parts, learning these separately, and then placing them together by some associative bonds, or by rehearsing the assignment as a whole. Experimental evidence favors what is known as the "whole" method. The study by Jewitt (957) was quite typical of others which have been made previously, and the investigations by Holloway (955) convinced

him that the "whole" method of teaching soccer is probably more effective than the "part" or "combined" method, and that the "combined" is probably more effective than the "part" method. Despite these findings there are very few coaches who follow the "whole" method, and some who place great emphasis upon the "part" method.

Motor skill is probably not secured except in specific directions. A good sprinter may be a poor swimmer, or a fine athlete may be a poor gymnast. Remembering the neural basis for skilled performance, the explanation is not difficult. Like reflexes, skills are responses of a mechanism of the body, not of the entire organism. However, Crocket (937) believed that manual ability has some of the characteristics of a distinct trait, and Seashore (969) found that a few highly selected athletes from all sports excel on the average on the two pursuit tests and were average or better on other tests, while a few highly selected pianists showed average superiority on serial discrimination and motor rhythm, and were about average on the remaining tests. He further concluded that the independence of skills measured in these tests argues against any theory of general motor ability and in favor of specific skills.

### **Methods of Teaching and Coaching**

In physical education the most highly specialized teaching has been developed in those activities lending themselves to competition. To such teaching the term *coaching* is commonly applied.

Griffith (944, 945) is the leading guide since he put into usable form psychological principles as applied to physical education.

Teachers in this field have certain advantages over those in the so-called academic subjects. Adequate motivation is usually present in the situation itself. Normal young people are interested in activity, so there is little need for added appeal through various devices. Objectives may be clearly defined and placed on a project-activity basis so that the pupils work definitely with a stated attainment in view. The efforts themselves are visible and easily measured, so self direction results and the activity becomes purposeful. Demonstrations of correct performance are easily made and easily understood. Activities may be analyzed into their mechanical parts and the details clearly shown. Cureton (938) gave a good example of this analysis technic as applied to the crawl stroke in swimming. Errors of the novice are noted without difficulty and may be corrected before they become established. Griffith (948) treated this in connection with basketball. Performances lend themselves to graphic representation by photography and electric transmission, as was shown by Fenn (942) in relation to sprinting, and by Miles (962) in the recording of times.

In connection with general methods of teaching physical education Schwendener (970) discussed the pros and cons of two fundamentally different plans, namely, authoritative and developmental.

The former is represented by the "formal" or "command" method, in which both the time and nature of responses expected from the class are under the control of the teacher. In "imitation" the leader "sets" the exercise and the pupils endeavor to follow. Here also the pupils are under direction. Contrasted with this, the "developmental" allows both the nature and time of the response to be self determined by the pupils. These are known as the "informal," "creative," or "self testing" methods, and represent spontaneous activity. The field of method was studied and reported upon further by Pendergast (966) and by Atkinson (929).

Teaching methods as applied to specific sports have received more detailed attention. Among the recent studies are those by Cuthbert (941) as applied to tennis, and by Cureton (940) in connection with swimming. Griffith (946) considered the psychological effect upon players of the short passing game together with a fast versus slow breaking offense.

### **Tests and Measurements**

In common with other subjects of the curriculum physical education wants to be regarded as "scientific," i. e. it must submit itself to laboratory examination, and have the facts collected and evaluated by statistical procedure.

McCurdy (961) suggested a comprehensive list of points on which a check-up is desirable, namely, medical examination, postural and organic measurements, physical skills, and health knowledge and habits. Wayman (972) listed thirty-three types of tests already in use in physical education and twenty-seven qualities being tested. She outlined aspects as follows: the student, the instructor, the methods, the tools, the results, and the overhead, and under each of these she elaborated into many details. Her article concluded with a tabulated list of reasons for testing. Bovard and Cozens (931) in their text claimed that the present basis of judging work in physical education is far from satisfactory, and brought together most of the testing and measuring schemes that have been employed, grouping them into historical divisions as the emphasis of different periods has shifted from one phase to another. The text includes sections on statistical methods, graphing, scoring, criteria for selection, test construction, and technic of administration. It is the most comprehensive text at present available.

Crapser (936), speaking for the National Physical Achievement Standard Committee, submitted tentative standards with directions for administering and scoring. For college women Lensch (960) offered a general athletic ability test. Clegg (934) worked out another plan and scoring table to measure performance. Beall (930) concluded from experiments performed that it is practicable to work out a simple test for measuring many of the qualities of good tennis players. Cureton's tests in swimming (939) were designed for testing, classifying, and instructing. The scoring provided that

rating is based partly upon improvement and so may be used for plotting the learning curve of a participant. Griffith (943) mentioned the equipment in his research laboratory, listed twenty-five psychological problems being considered in connection with athletics, and mentioned tests now being employed for certain specific skills.

Testing and measuring are themselves subject to scrutiny. Howe (956) pointed out that there are many sources of error and suggested the following: errors in the instruments, residual errors, personal errors, errors of method, errors of validity, and accidental errors. He emphasized the necessity of precision in handling data in order that validation may be possible.

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- Time allotment**, actual practice, 30; experimental, 31; bibliography, 59.
- Visual aids**. *See*, Reading, and other similar headings.

## AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

**T**HIS Association is composed of persons who are engaged in technical research in education, including directors of research in school systems, instructors in educational institutions, and research workers connected with private educational agencies. The Association became a Department of the National Education Association in July, 1930.

*Active Membership*—Persons eligible to membership in the Association must be recommended to the Executive Committee by a member who is in good standing. Upon approval of the recommendation, the person recommended will be invited by the Executive Committee to become a member of the Association. The Executive Committee has defined the qualifications for membership as follows:

"Membership in the Association is restricted to persons of good ability and sound training who are working in the field of educational research, and who can present satisfactory evidence in the form of published or unpublished studies which show ability to arrange, to organize, and to conduct research investigations and experiments. In addition, evidence of an abiding interest in the field of educational research is essential."

*Membership in the National Education Association* is a prerequisite to active membership in the American Educational Research Association. Any form of N. E. A. membership—annual, five-dollar, or life—satisfies the preliminary requirement.

### TOPICS OF THE REVIEW, 1932

The Association has several committees at work preparing numbers for the 1932 volume of the REVIEW. The order in which the various reports will appear has not been determined as yet, but the topics include the following: Special Methods in the Secondary Schools and Colleges; Individual Differences; Finance and Business Administration; Buildings, Grounds, Equipment and Supplies; Educational Tests and Their Use.